XITRON TECHNOLOGIES

USER'S GUIDE

2574R
SYSTEM MULTI-TUBE
BALLAST ANALYSER

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Introduction

The purpose of this user guide is to describe the capabilities, application, and maintenance of the 2574R Multi-Tube Ballast Analyser System.

Scope

The 2574R analyzes both the electrical power being delivered to and returned from single-tube ballasts, multi-tube ballasts and multiple single- and multi-tube ballasts. The analysis can be performed one at a time or in automatic succession. The rear panel provides the needed connections required for a wide variety of ballast testing and systems interfacing.

The analyser displays results in numeric and graphic waveform formats. Results include voltage, current and power, harmonics, and plots of measured results vs. time.

Available Models and Options

This manual primarily describes the 2574R. The 2571R, 2572R and 2573R models are similar to the 2574R, but with measurement capability for tube A (2571R), tubes A and B (2572R), tubes A, B, and C (2573R). Whereas, the 2574R has measurement capabilities for A, B, C and D. Line measurements are available for all four inputs in all models.

All models have all connectors fitted to the rear panel. You may connect signals through connectors that are not measured by the model in use in a normal manner, without any effects on the ballast.

Option QS

This is a reduced cost option, allowing only two-pin tube connections (not available with option HID).

Option HID

Allows only two-pin tube connections, has higher tube current (3Apk) and voltage measurement (4.5KVpk) capabilities, higher tube voltage withstand (3KVpk/1KVrms continuous, 4.5KVpk/2.5KVrms for < 2 minutes).

Option HC

Extends tube current measurement capabilities to 3Apk (6Apk with option HID).

Option HI

Extends tube voltage withstand capabilities to 4.5KVpk (standard with option HID).

Option F

Restricts specifications up to 100KHz (specifications unchanged below 100KHz) with a controlled 2MHz 3dB bandwidth.

Option M

Gives improved tube voltage measurement accuracy for tube voltages above 500Vpk, limits tube voltage measurement range to 1.5KVpk (not available with option HID).

Features

The 2574R Ballast Analyser's features include the following—

- Simple interface.
- Displays all relevant ballast measurements on a single screen.
- Displays ballast input or output harmonics in an easy to read bargraph format. IEC61000-3-2 (Class C) results are also available with a pass/fail indication.
- Data logging of many ballast measurements over periods from seconds to days. Results may be obtained either graphically (via front panel or printout) or numerically (via IEEE488 or RS232 interface) with 200 point time resolution.
- Fully automatic ballast startup and tube striking detection and data logging. Results may be obtained either graphically (via front panel or printout) or numerically (via IEEE488 or RS232 interface) with down to 1ms time resolution.
- Automatic selection of resistive loads to simulate real tubes.
- Fully automatic test sequencing and complete comparison of measurements against limits. Including the selection of different 1500 series load modules and engagement of 1500 series line switch modules.
- Ability to operate up to 7 additional 2574R instruments for parallel ballast testing, controlled via one front panel, IEEE488 and RS232 interface.
- IEEE488 or RS232 control of up to 4 external AC sources. Allows single user interface.
- High-Speed operation with: ballast input measured in ½ cycle periods; ballast outputs measured in 512µs periods.

- Wide bandwidth, ballast output frequencies of up to 2MHz can be accurately measured (harmonics up to 450KHz).
- Uninterrupted coverage of ballast input and output signals, sampled at high speed (up to 2M sample/sec), ensures accurate peak detection for inrush currents and striking voltages.
- All pins on each tube are measured for voltage and current, ensuring the ballast is fully tested.
- Very low capacitive burden, ensuring that the ballast is tested in normal conditions.
- Built-in printer interface enables a comprehensive test report to be printed in a semi-automatic test environment, or for recording results in an engineering environment.

Functional Description

This chapter illustrates the 2574R Ballast Analyser's functionality using block diagrams.

Theory of Operation

The 2574R is high performance test equipment for testing ballasts. Within the analyser, voltage and current signals are converted to digital data using DSP chips where the signals are sampled automatically and periodically. A to D converters scale and sample data.

For an overview of the analyser, refer to the block diagrams shown in *Figure 1* through *Figure 3*. The abbreviations used in the diagrams represent the following components or functions—

ADC	Analog to Digital Converters
DSP	Digital Signal Processor
FIFO	First In / First Out Memory
Hall	Hall Effect Transducers
I/O	Input / Output signals
RAM	Random Access Memory

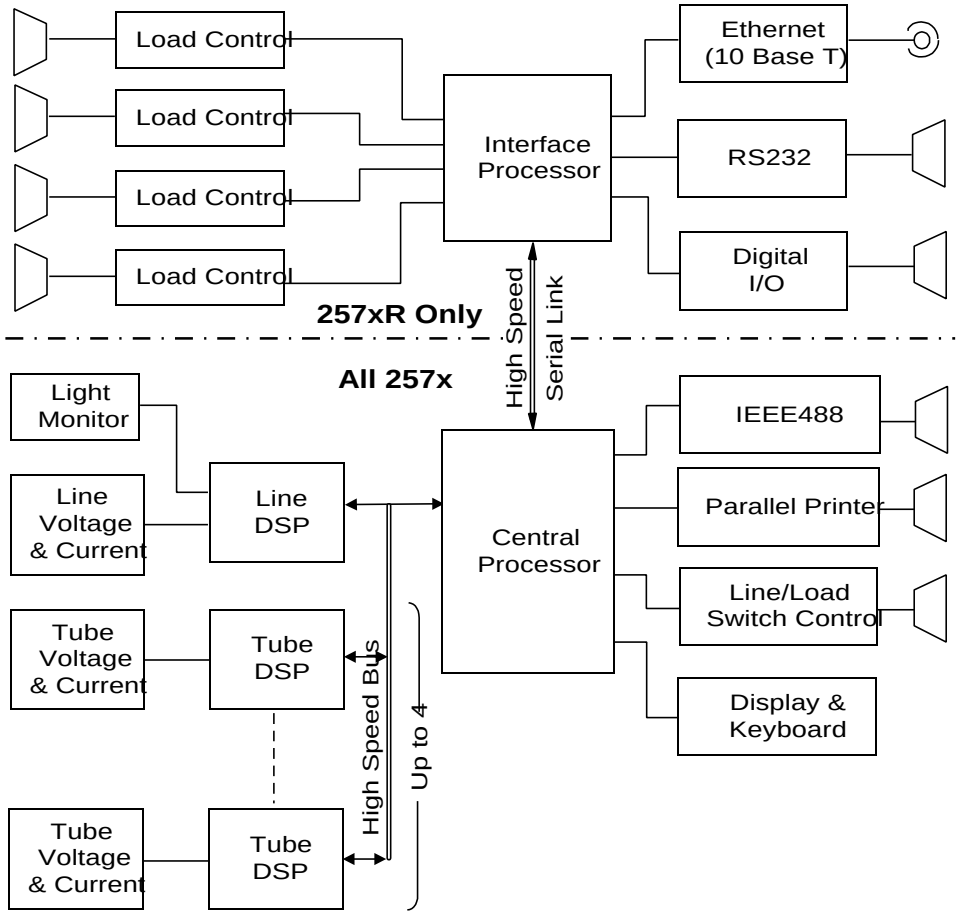


Figure 1. Overall Block Diagram

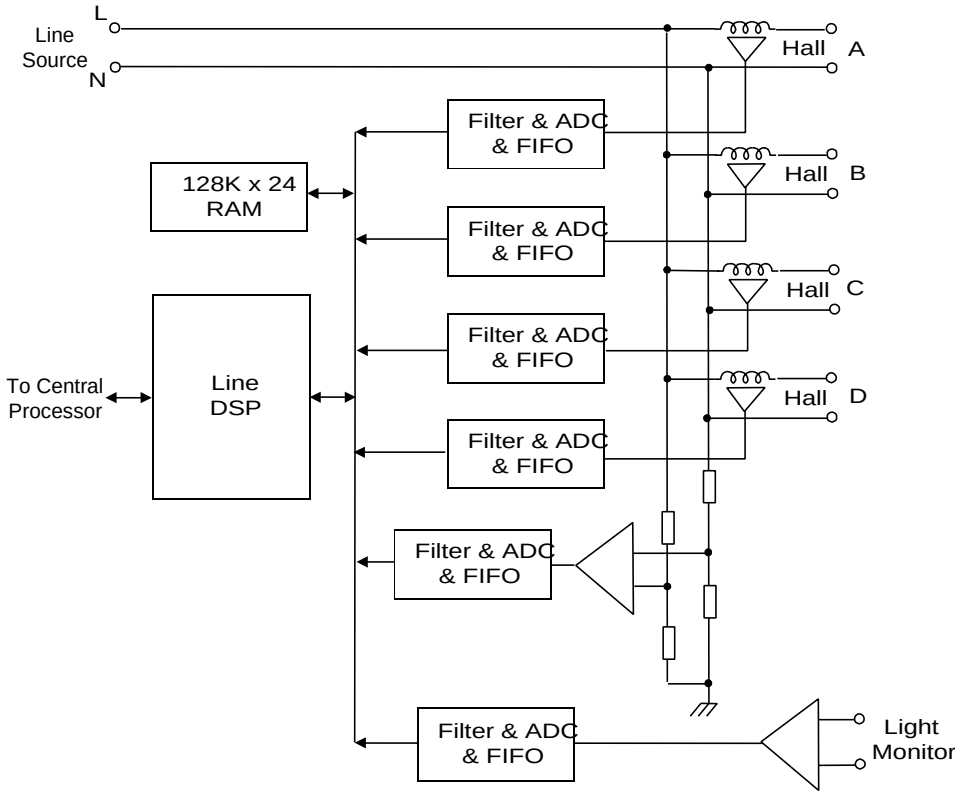


Figure 2. Line Block Diagram

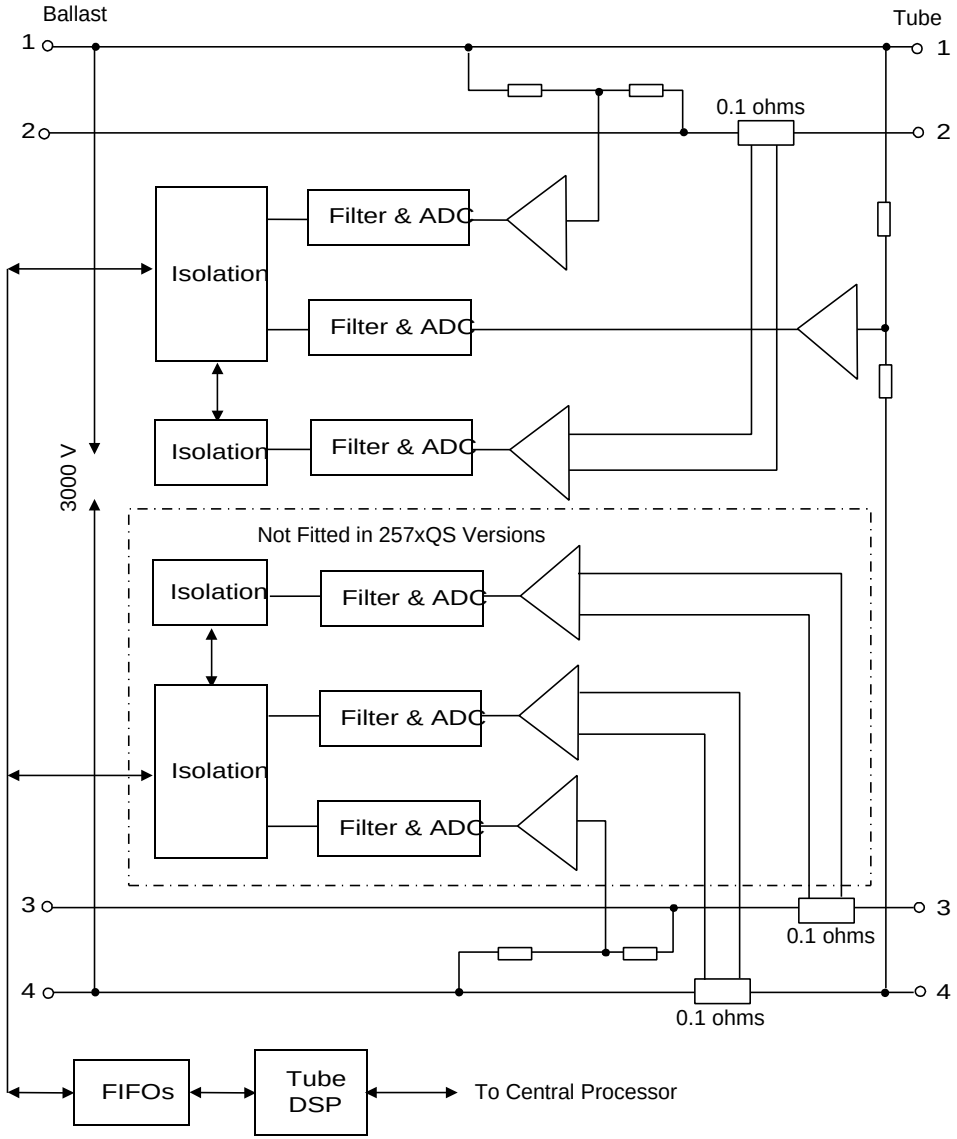


Figure 3. Tube Block Diagram

Installing and Maintaining the Analyser

This chapter discusses the setup, precautions and periodic maintenance for the 2574R.

Installation

Arrange the 2574R instrument in a convenient position on your bench allowing for easy access to the connectors on the rear panel, or mount the instrument in a standard 19” rack enclosure using the supplied rack mount brackets. Ensure that no heavy instruments are placed on top of the case and that sufficient airflow is provided around the instrument.

The rear panel contains the connectors for attaching the instrument to power, a printer, and a PC.

There are no restrictions against signals being present on these connections when the 2574R is not powered.

WARNING: *SHOCK HAZARD. NEVER CONNECT OR DISCONNECT ANY LIVE SIGNALS TO THE 2574R. THIS CAN BE LETHAL TO YOU AND MAY DAMAGE THE INSTRUMENT.*

WARNING: *IF THE POWER ANALYSER IS USED IN A MANNER NOT SPECIFIED BY XITRON TECHNOLOGIES INC., THE PROTECTION PROVIDED BY THE EQUIPMENT MAY BE IMPAIRED.*

Applying Power the 2574R

Insert the socket end of a power cord into the analyser. Insert the plug end into an 85-250 volt AC, 47-400 Hz outlet. Ensure that a grounded power cord is used, and that the power cord fully complies with the regulations pertinent to the country and district in which the instrument is being used.

Connecting a Printer to the 2574R

Connect one end of your printer's cable to the PARALLEL PRINTER port and the other to the printer. Use a standard IEC1284 compliant cable, similar in type to the cable used to connect the printer to an IBM PC compatible computer.

Connecting a PC to the 2574R using IEEE488

Attach the computer's IEEE488 cable connector to the 24-pin socket marked IEEE on the back panel using an IEEE488 compliant cable.

Connecting a PC to the 2574R using RS232

Attach the computer's RS232 cable connector to the 9-pin socket marked RS232 on the back panel. The 2574R rear panel connector is a male connector having the following signals. The 2574R is considered a DTE (Data Terminal Equipment), computers are normally a DCE (Data Computer Equipment).

- Pin 1 – DCD (Data Carrier Detect). Input to the 2574R, should be a high logic level for correct RS232 operation.
- Pin 2 – RXD (Receive Data). Input to the 2574R, serial data path to the 2574R from a computer.
- Pin 3 – TXD (Transmit Data). Output from the 2574R, serial data path from the 2574R to the computer.
- Pin 4 – DTR (Data Terminal Ready). Output from the 2574R, high logic level when the 2574R is powered and the RS232 interface is enabled.
- Pin 5 – Ground return. Connected to the 2574R chassis ground.
- Pin 6 – DSR (Data Set Ready). Input to the 2574R, should be a high logic level for correct RS232 operation.
- Pin 7 – RTS (Ready To Send). Output from the 2574R, high logic level when the 2574R is able to receive data from the computer.
- Pin 8 – CTS (Clear To Send).. Input to the 2574R, high logic level when the computer can accept data from the 2574R.
- Pin 9 – not connected.

Precautions

Please read the following precautions before installing the 2574R—

- Ensure that all rear panel connections are not physically stressed, and that all connectors are securely latched.
- Ensure that no loose wires or metal objects can touch any unused connectors on the rear panel.
- Ensure that the instrument has sufficient airflow around the bottom and top faces of the case. Take particular care that the air vents in the 2574R’s case are not blocked in any way.

- If mounting the instrument in a system enclosure, it is recommended that the enclosure have freely moving airflow around the 2574R. A minimum free air space of at least 2" above and 0.5" below the casing of the 2574R unit is recommended.

WARNING: *ENSURE THAT THE POWER CORD USED TO PROVIDE THE 2574R'S POWER HAS A CONTINUOUS GROUND CONNECTION. FAILURE TO PROPERLY GROUND THE 2574R MAY RENDER THE INSTRUMENT UNSAFE FOR USE.*

CAUTION: *VERIFY THAT THE POWER CORD FULLY COMPLIES WITH THE REGULATIONS PERTINENT TO THE COUNTRY AND DISTRICT IN WHICH THE 2574R IS BEING USED.*

- Do not setup the 2574R near a source of line frequency magnetic fields, such as powerful transformers. The line frequency current transducers in the 2574R are of the Hall Effect type, and can respond to strong external magnetic fields. To test for the effect of these fields on the 2574R, view the Numeric Measurement Results screen for each ballast with no applied signals and check that the ballast line input current is less than 0.5mArms. For unaffected results, position the 2574R at least 12 inches away from any AC power source and at least 6 inches away from any magnetic ballast.
- Use high quality shielded cables when interfacing the 2574R to a computer and/or a printer. The high voltage, high frequency signals usually associated with high frequency ballasts can easily interfere with the signals on these interfaces, which are not designed for significant interference rejection.
- Ensure that the wiring used to connect the ballast and tube to the 2574R has sufficient insulation for analysis of the voltage and frequency signals. This is of particular importance when testing HID ballasts.

WARNING: SHOCK HAZARD. *NEVER CONNECT NOR DISCONNECT ANY LIVE SIGNALS TO THE 2574R. THIS CAN BE LETHAL TO YOU AND MAY DAMAGE THE INSTRUMENT.*

Periodic Maintenance

The periodic maintenance required for the 2574R involves a few simple precautions to ensure a long and productive life for the analyser. Scheduled maintenance contracts are available for U.S. customers from Xitron Technologies Inc.

The maintenance precautions include—

- Performing annual external calibrations, which include multiple operational tests.
- Using *DC Zero* function when measuring DC content or if a large change in ambient temperature is encountered (> 10°C). Refer to *Setting DC Zero Function* shown on page *26* .
- Cleaning the display and rear panel surfaces regularly.

Clean the surfaces with all power and ballast signals removed from the 2574R.

Use a soft cloth, dampened with clean water and a small amount of pure liquid detergent. Detergent should NOT form lather. Ensure that the detergent does not have aromatic or ammonia additives. Simple dish washing liquid is often the best to use for this purpose. Dry surfaces with a soft cloth. Ensure that a non-abrasive cloth is used, and that no lint is left on the surfaces or in the rear panel connectors.

Avoid allowing fluid to enter the 2574R, especially through the rear panel. If a small amount has entered the instrument, allow the 2574R to stand for at least 4 hours before applying power or ballast signals.

The period between cleaning is dependent on the environment in which the 2574R is used. Annual cleaning is sufficient in most applications. However, if the environment is particularly adverse and/or humid, clean as often as needed.

Starting the Analyser

This chapter describes the Front Panel and directs you to the **Configuration** screen that displays on the Front Panel. This chapter covers the following subjects—

- Front Panel Interface
- Starting the 2574R
- Viewing the Configuration screen
- Setting date and time
- Resetting DC Zero Function
- Selecting a Mode and Configuring Options

Front Panel Interface

The 2574R's front panel allows you to access screens, select operating modes, choose submenu options, and view and print the analyser's results.

POWER

This switch turns the power to the 2574R on and off.

NEXT

This button stores any edits made and changes the screen to the next group of display screens in sequence.

Softkeys

The F1, F2, F3, and F4 buttons allow you to select menu choices. The functions of these softkeys are dependent on the screen that is presently displaying. The softkeys give you access to additional displays within a group or allow you to change the display's format. The present state or action of each softkey shows on the screen immediately above each button as a text label. When no text is shown, that key has no effect for that screen.

PRINT

This key performs a printout of the stored configuration of the 2574R in the selected operating or test mode. For example: If PRINT is pressed while a **Check** submenu choice is highlighted, then the complete list of the check parameters selected will print.

Starting the 2574R

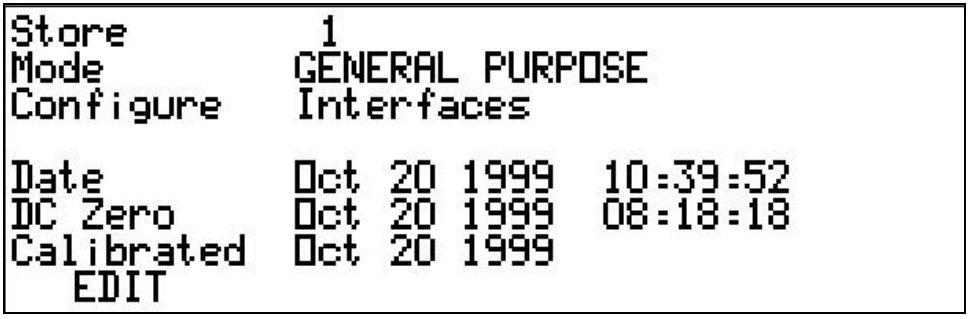
- Press the ON button. A startup screen will display for a few seconds. This screen lists the model number, option content, firmware revision number, date, and time. In the rare situation where non-volatile data has become corrupted (i.e. calibration, configuration, test sequence or test limit data), then error messages are displayed within this screen using reversed text (clear characters in a dark background).
- A test screen will display next for a few seconds. In this screen you can check if the Measurement, Line and Tube digital signal processors are detected. You can select CONTINUE or RETEST.

Note: *The next screen you see after the DSP Retest screen is the same screen that was displaying when you last turned the analyser off.*

WARNING: *IF THE POWER ANALYSER IS USED IN A MANNER NOT SPECIFIED BY XITRON TECHNOLOGIES INC., THE PROTECTION PROVIDED BY THE EQUIPMENT MAY BE IMPAIRED.*

Viewing the Configuration Screen

The **Configuration** screen allows you to select operating modes, configure the modes, set the date and time, reset DC Zero and shows the most recent Calibration date. Press the NEXT button, as required, until the **Configuration** screen displays.



The **Configuration** screen is characterized by the softkey EDIT in the F1 position. EDIT is the only active softkey each time this screen first displays. If you wish to select a new mode or modify a configuration in any way press EDIT. Immediately the softkeys F1 through F4 will change functionality. It is possible to lockout front panel editing by an IEEE488 or RS232 command. If this has been enabled, then a password is required to actually change any data. The password will have been set via the IEEE488 or RS232 command and should be entered when requested. For more information, refer to the *Interface Command Guide for the 2574R Multi-Tube Ballast Analyser*.

Refer to the following softkey functional descriptions available in the **Configuration** screen—

F1-EDIT; CURSOR

Press EDIT to initiate a change to an item on this screen. Press CURSOR to select the next editable item on the display. The selected item will be highlighted.

F2-CHANGE

Press CHANGE and the highlighted selection is changed to the next available option. If you pass an option, continue pressing CHANGE to return to that option.

F3- SETUP; PRESET; PERFORM, VIEW

Press SETUP while the **Configure** option is highlighted to open the submenu related to that configuration option. Press PRESET while a submenu is open to display preset incremental options. Press PERFORM to initiate the selected calibration to be performed. Press VIEW to view informative data that cannot be altered by the user.

Note: *If the date and time of the last DC zero correction was highlighted, then the presently measured DC offsets will be used for correction factors in future measurements. A message is displayed if the DC offsets are too large.*

F4- DONE

Press DONE to store the changes and return to the primary Configuration screen.

Selecting Modes and Configuring Options

The operation of the 2574R is primarily controlled by the selected mode. There are two modes, the General Purpose mode and the Test Sequence mode. The General Purpose modes enable the 2574R to continuously perform ballast measurements. These modes accommodate ballast developmental tasks. The Test Sequence modes enable the 2574R to perform a prescribed sequence of tests on a tube and/or ballast for quality control. Additional configuring is done by choosing test parameters that configure the selected mode. These selectable settings are accessible from the **Configure** submenu screens, as described above.

Up to 20 complete configurations of the 2574R can be stored in the instrument and recalled at any time, via front panel, IEEE488, RS232, or Digital I/O interfaces. The presently active configuration is separately maintained, also in a non-volatile manner.

RECALL A PREVIOUSLY STORED CONFIGURATION OR STORE THE PRESENT CONFIGURATION

1. As required, press NEXT until the **Configuration** screen displays.
2. Press EDIT. The EDIT softkey changes to CURSOR and a softkey to the right reads CHANGE.
3. Press CHANGE repeatedly until the desired configuration storage number is shown (highlighted in the uppermost line of the display). If this is performed in error then pressing the NEXT key aborts this procedure.
4. Either press the RECALL or STORE softkey as desired. The specified operation is performed, a message being displayed while being performed, and then the display returns to the non-editing configuration screen. The uppermost line always shows the most recently recalled or stored configuration number.

SELECT A MODE

1. As required, press NEXT until the **Configuration** screen displays.
2. Press EDIT. The EDIT softkey changes to CURSOR and a softkey to the right will read CHANGE. Note that the previously selected mode will be highlighted.
3. Press CURSOR, the presently selected mode is highlighted in the display.
4. Press CHANGE until the mode you wish to select displays. This softkey will toggle through the available options, one at a time.

***Note*:** *If you pass an option you desire, continue to press CHANGE.*

5. Switch back and forth from CURSOR to CHANGE, as required.
6. Press DONE when complete.

CONFIGURE A SUBMENU OPTION

1. In the **Configuration** screen press EDIT.
2. Press CURSOR to highlight one of the submenu options shown in the third line down.
3. Press CHANGE until the submenu you wish to configure displays. This softkey will toggle through the available options, one at a time. The options available are dependent on the configured mode.
4. Press SETUP to open the submenu screen.

5. In each screen, the name of the element you are configuring is shown on the left and the selectable settings are shown on the right. Press CURSOR to highlight the settings.
6. Press CHANGE and PRESET (when available) to display the various settings for each element. Switch between CURSOR and CHANGE, as required. Samples of the Configure submenu screens are shown in *Operating the Analyser in General Purpose Modes and Test Modes*.
7. To store your change, press DONE for each submenu screen when complete.

Setting the Date and Time

1. In the Configuration screen, press EDIT. The EDIT softkey changes to CURSOR and a softkey to the right will read CHANGE.
2. Press CURSOR to highlight: month, day, year and hour, minute, second. Time is in 24 hours, minutes and seconds.
3. When the selection you wish to modify is highlighted, press CHANGE. This softkey will toggle through the available options, one at a time.

Note: *If you pass an option you desire, continue to press CHANGE. Holding down the F2 softkey will automatically step through the options.*

4. Switch back and forth from CURSOR to CHANGE, as required.
5. Press DONE when complete.

Setting DC Zero Function

1. Ensure that the 2574R has been powered for at least 15 minutes.
2. Remove all analog signals from the 2574R. Connections and interfaces may remain in place, but ensure that no ballast or light monitor signals are present.
3. If necessary, press the NEXT button on the 2574R front panel until the **Configuration** screen displays.
4. Press F1-CURSOR until the *DC Zero* date and time information is highlighted on the display.
5. Press F2-PERFORM. The 2574R automatically adjusts the internal DC zero offsets within 1 second and updates the date and time information. If *DC Zero Error* displays, then one (or more) of the DC zero offsets is too large and corrective action should be taken.

Calibration Date

The calibration date automatically updates whenever calibration is completed. If you highlight this option, the PERFORM button displays.

Configuring the Analyser

This chapter describes the operating modes and their submenu options. This chapter covers the following subjects regarding the 2574R—

- Selecting an Operating Mode
- Configuring Options

Password Protection

The 2574R may be password protected against unauthorized changes by means of a command via the IEEE488 or RS232 interface. When activated, the user is restricted to viewing the configuration of the 2574R and recalling configurations that have already been stored in the 2574R. A user-defined password is required in order to change any configuration information. When initially shipped from Xitron Technologies, this password is disabled.

Storing and Recalling Configurations

Up to 20 complete configurations of the 2574R may be stored in the instrument in a non-volatile manner. Each stored configuration is independent and complete. Stores are numbered from 1 through 20 inclusive.

It should be noted that the configuration being used is also stored in a non-volatile manner, separately to the numbered storage system.

Each store contains a complete configuration:

- Operating Mode
- Instrument Configuration
- Test Sequence Definition
- Test Limits

Storing a Configuration

- As required, press NEXT until the **Configuration** screen displays.

- Press F1-EDIT. The EDIT softkey changes to CURSOR and the F2 softkey to the right changes to read CHANGE. The last used store number is highlighted.
- Press F2-CHANGE until the number of the store in which you wish to save the configuration is displayed. If a store is presently empty then ***Empty*** is displayed next to the store number.
- Press F4-STORE when the desired store number is highlighted. The instrument now stores the present configuration in the user set store number.

Recalling a Configuration

- As required, press NEXT until the **Configuration** screen displays.
- Press F1-EDIT. The EDIT softkey changes to CURSOR and the F2 softkey to the right changes to read CHANGE. The last used store number is highlighted.
- Press F2-CHANGE until the number of the store from which you wish to recall the configuration is displayed. If a store is presently empty then ***Empty*** is displayed next to the store number and the RECALL operation is inhibited.
- Press F3-RECALL when the desired store number is highlighted. The instrument now recalls the configuration from the user set store number.

First Time Use of the 2574R

It is recommended that the first time user of the 2574R should initially use the General Purpose mode of operation with a single ballast and actual tube loads. Each of the following sections show the recommended configuration for first time users.

Setting the Operating Mode

The 2574R may be operated in General Purpose mode or in Test Sequence mode.

General Purpose Mode

This mode allows the 2574R to perform continuous measurements on one or more ballast(s).

This is the recommended mode for first time users.

The 2574R can be configured to control a line power switch for each ballast (either using 1500 chassis or user built).

The 2574R can control the output voltage and frequency of one (or more) line power sources.

The 2574R can be configured to automatically time the selection of the tube portion of a resistive load (either using 1500 chassis or user built), or can be configured to use actual tube loads.

If the 2574R is configured to control either a line switch or a line source, then the 2574R front panel or interface can be used to turn on/off the line power to the ballast. The startup of the ballast is automatically determined by the 2574R when the ballast initially draws line current.

Test Sequence Mode

This mode allows the 2574R to perform a sequence of tests on one or more ballast(s), applying differing line voltages, frequencies and loading conditions as programmed by the user.

The 2574R can be configured to control a line power switch for each ballast (either using 1500 chassis or user built).

The 2574R can control the output voltage and frequency of one (or more) line power sources.

If the 2574R is configured to control either a line switch or a line source, then the 2574R can perform testing or both running and startup conditions under different line voltage and frequency conditions. Power application to each ballast is automatically sequenced in this configuration to reduce the inrush requirement on the line source, or the 2574R can be configured to operate separate line sources for each ballast. Otherwise, the test sequence is automatically started when line current draw is initially detected for each ballast.

The 2574R can be configured to automatically time the selection of the filament and tube portions of resistive loads (either using 1500 chassis or user built), or can be configured to use actual tube loads, or to control resistive loads in an exact timed manner. Individual control of each ballast output's load is provided when used with a 1500 chassis.

Interactive wait periods can be programmed by the user, to allow for user adjustments within the ballast(s) being tested, with continuously applied limits available while the adjustments are being made.

Changing the Operating Mode

- As required, press NEXT until the **Configuration** screen displays.
- Press EDIT. The EDIT softkey changes to CURSOR and a softkey to the right will read CHANGE.
- Press CURSOR, the presently selected mode is highlighted in the display.
- Press CHANGE until the mode you wish to select displays. This softkey will toggle through the available options, one at a time.
- Switch back and forth from CURSOR to CHANGE, as required.
- Press DONE when complete.

Configuring the Instrument

The third line of the Configuration screen allows the user to choose a configuration area to edit using a submenu.

- In the Configuration screen press F1-EDIT.
- Press F1-CURSOR to highlight one of the submenu options shown in the third line down.
- Press F2-CHANGE until the submenu you wish to configure is highlighted. This softkey toggles through the available options, one at a time.
- Press F3-SETUP to open the submenu screen.
- In each screen, the name of the element you are configuring is shown on the left and the selectable settings are shown on the right. Press F1-CURSOR to highlight the settings.
- Press F2-CHANGE and F3-PRESET (when available) to display the various settings for each element. Switch between F1-CURSOR and F2-CHANGE, as required.
- In each submenu screen, the F4-DONE key returns to the main configuration screen.
- To make all of your changes permanent, press F4-DONE in the main configuration screen.

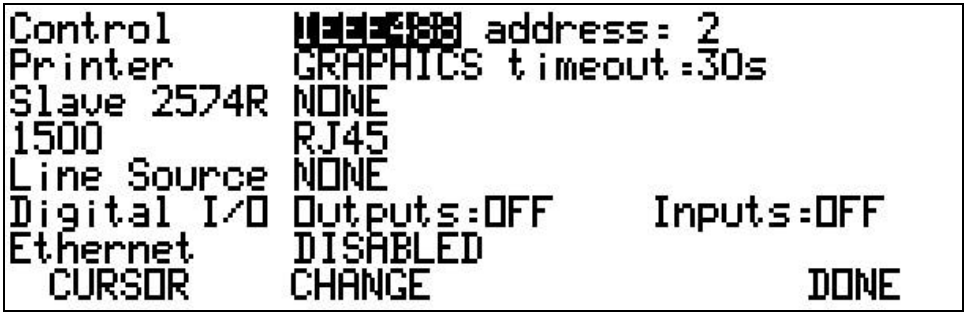
When configuration changes are made, then the following actions are taken by the 2574R –

- Any measurements in progress (in either mode) are aborted.
- All line switches and loads are disconnected (if controlled).
- All profiles, and all inrush, preheat and strike measurements are initialized.
- If any interface changes are made, then all interfaces are initialized.

The following paragraphs describe the various areas that may be configured by the user.

Configuring the Interfaces

The Interface submenu allows you to configure the RS232, IEEE488, Digital I/O, 1500 switch chassis, Ethernet and Parallel Printer interfaces. This submenu is available in both operating
modes.



It is recommended that first time users set the following –

- **Remote Control** set to IEEE488 at any desired address.
- **Printer** set to GRAPHICS and no timeout.
- **Slave 2574R** set to None.
- **1500 Chassis** set to None.
- **Line Source** set to None.
- **Digital Outputs** and **Inputs** set to OFF.
- **Ethernet** set to Disabled.

Remote Control Interface

This display line allows the user to select which (if any) interface is to be used for remotely controlling the 2574R. The available selections are –

1. **IEEE488 Address XX**. Selecting that the IEEE488 interface is enabled, and talks/listens at the specified address (in the range 0 through 30). Note that if the IEEE488 interface is used in this manner then this interface cannot be selected for either 1500 chassis or line source control.
2. **RS232 XXXXXXbaud**. Selecting that the RS232 interface is enabled, and talks/listens at the specified baud rate (up to 115200). Note that the RS232 interface can only be used for one purpose.
3. **None**. Selecting that neither the IEEE488 nor RS232 interfaces are to be used for this purpose. The 2574R can only be controlled via the front panel.

Printer Interface

This display line allows the user to select the type of printer (if any) and the timeout to be used when printing information. The printer type selection is either –

1. **NONE**. Selecting that no printer is connected. The front panel PRINT key is inactive and any configured test report printouts are not performed.
2. **TEXT**. Selecting that a text only printer is connected. Only textual printouts (either using the PRINT key or configured test reports) are performed.
3. **GRAPHICS**. Selecting that the connected printer supports both text and graphics, using the PCL2 standard.

Slave 2574R Control

This display line allows the user to select whether further 2574R instruments are to be controlled by this 2574R as slaves for either multi-tube or multi-ballast testing. If the IEEE488 interface is configured for 2574R CONTROL purposes then this selection is always Inactive.

When using multiple 2574R instruments in this manner, the slave 2574R instruments should be configured by the user for IEEE488 2574R CONTROL operation using unique addresses for each instrument, along with any additional “local” interface requirements. All other aspects of the configuration of the slave instruments are automatically performed by the controlling 2574R without user intervention. Note that any measurements or test results from any specific slave instrument can be obtained via the RS232 interface of the controlling instrument.

The available selections are –

1. **None**. No 2574R slave control is exercised when configured in this manner, the IEEE488 interface being configured as otherwise selected.
2. **Multi-Ballast**. In this case the IEEE488 interface is configured at address 1 as a controller. The F3 key displays SETUP when this is selected, allowing the user to select the actual addresses for up to 7 additional 2574R instruments to be controlled by this 2574R. When configured in this manner, the BALLAST TYPE & WIRING for each slave instrument is configured identically to the controlling instrument, slave #1 ballast being obtainable within the controlling instrument as ballasts #5 through 8, slave #2 as ballast #9 through 12 etc.. If a slave instrument cannot be located at the specified address when the user interrogates its’ results, then an error message is displayed at that time.

3. **Multi-Tube**. In this case the IEEE488 interface is configured at address 1 as a controller. The F3 key displays SETUP when this is selected, allowing the user to select the actual addresses for up to 7 additional 2574R instruments to be controlled by this 2574R. When configured in this manner, the BALLAST TYPE & WIRING for each slave instrument is configured similarly to the controlling instrument, slave #1 tubes being obtainable within the controlling instrument as tubes E through H, slave #2 as tubes I through L etc.. Note that only 7 instruments can be effectively used in this manner, and the seventh instrument can only effectively use two tubes. If a slave instrument cannot be located at the specified address when the user interrogates its' results, then an error message is displayed at that time. The line current measurements of each slave device are unused in this configuration, however the line voltage must be present on each instrument.

1500 Interface and Control

This display line allows the user to select the method that the 2574R uses to communicate with 1500 line/load switch chassis connected to the 2574R. Up to 8 chassis may be controlled by the 2574R using the RJ45 or IEEE488 interfaces, or one using the RS232 interface. While this display line is selected, the F3 key displays SETUP when configured for IEEE488 control. Pressing the F3 key in this situation allows the user to configure the specific IEEE488 address for each 1500 chassis connected to the 2574R. It is not necessary to have the 1500 chassis connected to the 2574R, or powered, at this time.

The 1500 chassis communication type selection is either –

1. **None**. Selecting that there are no 1500 chassis being controlled by the 2574R.
2. **RJ45**. Selecting that one (or more) 1500 chassis are to be controlled using the eight rear panel RJ45 connectors. Any of the connectors may be used, however using the lowest numbered available is recommended.
3. **IEEE488**. Selecting that the IEEE488 interface is enabled and configured as a controller, using address 1. Note that this selection is not available if the IEEE488 interface has been enabled for 2574R CONTROL purposes, also note that the address (1) is that used by the 2574R interface. When this selection is being shown, the F3 softkey shows SETUP. Press the F3 key to configure the specific IEE488 addresses of the (up to 8) 1500 chassis to be controlled.
4. **RS232 XXXXXXbaud**. Selecting that the RS232 interface is enabled and configured to control a single 1500 chassis. Note that this selection is not available if the RS232 interface has been enabled for 2574R CONTROL purposes. Ensure that both the 2574R and the 1500 chassis are configured for the same baud rate.

Line Source Control

This display line allows the user to select the method that the 2574R uses to communicate with up to 4 line sources. While this display line is selected, the F3 key displays SETUP. It is not necessary to have the line source(s) connected to the 2574R, or powered, at this time. Note that the line source is controlled for output voltage, output frequency and output on/off status (as available).

The line source communication type selection is either –

1. **None**. Selecting that there are no line sources being controlled by the 2574R.
2. **IEEE488**. Selecting that the IEEE488 interface is enabled and configured as a controller, using address 1. Note that this selection is not available if the IEEE488 interface has been enabled for 2574R CONTROL purposes, also note that the address (1) is that used by the 2574R interface. Press the F3 key to configure the specific IEE488 address and line source type of each (up to 4) line source being controlled.
3. **RS232 XXXXXXbaud**. Selecting that the RS232 interface is enabled and configured to control a single line source. Note that this selection is not available if the RS232 interface has been enabled for 2574R CONTROL or 1500 CHASSIS purposes. Ensure that both the 2574R and the line source are configured for the same baud rate. Press the F3 key to configure the specific line source type of the line source being controlled.

Digital I/O Interfaces

This display line allows the user to make the Digital Input and Output interface Active or Inactive and to configure the specific uses of each section of the digital I/O interface using the F3 (SETUP) key when configured as active. Setting the interface inactive does not affect the stored configured use of each I/O section, this information is still available for use when subsequently made active.

The interface consists of 16 TTL compatible digital outputs and 8 TTL compatible digital inputs. The inputs have 10Kohm pull-up resistors to +3.3V, and can tolerate signals up to +5V. The outputs are actively maintained at either logic level, using 0V/3V logic levels (TTL compatible). These signals are available in the rear panel of the 2574R on a 25-pin male D type connector, each pin being configurable in the relevant menu. Pin 25 is the chassis ground common signal return.

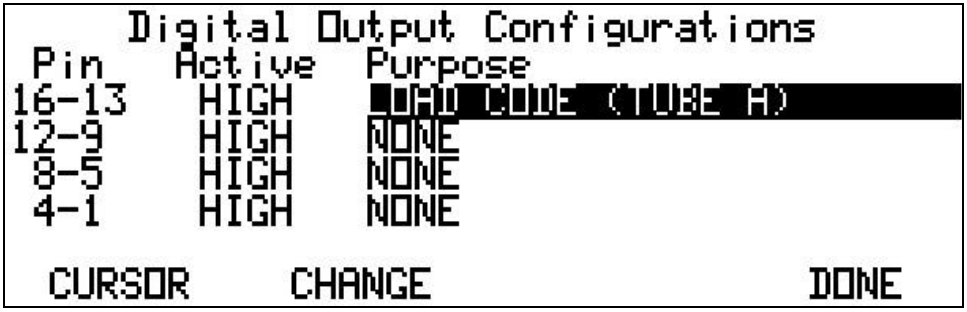
DIGITAL OUTPUTS

Digital Outputs may be configured as *Inactive*, *Mux*, or *Static*.

Digital Outputs when Configured as OFF

All outputs are held in the high logic state. No further configuration is possible, however any individual configurations made while set for *Mux* or *Static* are retained for later use.

Digital Outputs when Configured as STATIC



The Digital outputs are configured as four sets of 4-pins each. Each set of four pins can be independently configured by using the F3-SETUP key to access the digital output configuration menu.

The available sets of pins are pins 16-13, 12-9, 8-5, and 4-1. In each set, the higher number pin of the connector is the least significant bit of the code.

Each set can be configured as active high or active low logic. Note that the state of all digital outputs is open circuit for a short period following power application.

The selections available for each set of 4 pins are as follows -

1. **NONE**. All bits are held in the inactive state.
2. **LOAD CODE A, B, C or D.** A 4-bit code representing the required load # for the specified tube section. This load # (binary code) may be selected in the test steps (using codes 0 through 15) of the 2574R, and can be changed for each test step configured by the user. Test steps using codes outside of the range 0 through 15 yield a code of 0 for this purpose.
3. **LINE SOURCE ENABLE.** Each of the 4 pins enable the presently selected line source (A through D respectively). The signals are independent of the line engage selection.
4. **LINE SWITCH ENGAGE.** Each of the 4 pins indicate the required on (active) or off (inactive) state of each line switch (A through D respectively). The signals are controlled by the 2574R as part of the test procedure, or can be simultaneously switched by the user (front panel or interface) in the General Purpose modes.
5. **FILAMENT LOAD ENGAGE.** Each of the 4 pins indicate the required on (active) or off (inactive) state of each filament load (sections A through D respectively). The signals are controlled by the 2574R as part of the test procedure, in the General Purpose modes these are either always active (Auto-Load) or inactive (Tube Load).
6. **TUBE LOAD ENGAGE.** Each of the 4 pins indicate the required on (active) or off (inactive) state of each tube load (sections A through D respectively). The signals are controlled by the 2574R as part of the test procedure, in the General Purpose modes these are either always active (Auto-Load) or inactive (Tube Load).

7. **TESTING FLAGS.** Each of the 4 pins indicate the present test in progress status for ballast #1, 2, 3 or 4 respectively. The signals are asserted when a test procedure is actually being run (Test Sequence modes) on the respective ballast or are always asserted (General Purpose modes). Note that these signals are unasserted when a critical failure condition occurs (test result code 4 or higher), or the test is aborted.

8. **TEST RESULTS 1,2,3** or **4.** A 4-bit binary code representing the result of the test (updated while running, held when completed) on ballast #1, 2, 3 or 4. The code is as follows:
   0 : No test result is available (or in General Purpose mode).
   1 : A test is presently running with no failures
   2 : All tests have passed (only when completed)
   3 : A "non-critical" test failed
   4 : The test was aborted by the user
   5 : A critical test failed (the test was aborted)
   6 : An externally generated failure occurred
   7 : The test was aborted due to the lack of a line/source switch
   8 : The test was aborted due to the lack of a load
   9 : The test was aborted because an open ballast was detected
   10 : The test was aborted because a shorted ballast was detected
   11-15 : Reserved for future use

9. **TEST FAIL FLAGS.** Each of the 4 pins indicate the pass (inactive) or failed (active) state of the presently running, or last completed test for ballast #1 through 4 respectively. The signals are always asserted in the General Purpose mode. Referring to the TEST RESULTS codes listed above, 3 and above constitute a failure for this purpose.

10. **TEST STEP CODE.** An 8-bit code defined by the user for each test step being executed. The code is always set to zero when no test step is being executed, a General Purpose mode is selected, or when programmed as such by the user (see the description of TEST STEPS later in this manual). The user separately configures the upper 4-bits and the lower 4-bits of the code.

11. **WAIT FAIL FLAGS**. Each of the 4 pins indicate the pass (inactive) or failed (active) state of the test condition of the presently running INTERACTIVE WAIT test step for ballast #1 through 4 respectively. The signals are always unasserted when not running an INTERACTIVE WAIT test step or in the General Purpose mode.

12. **OUTPUT TIMING PULSE.** Only the higher numbered pin is used in this configuration. The signal is asserted at least 1 microsecond prior to any of the other digital outputs changing, and is unasserted at least 1 microsecond after all changes have been completed.

Digital Outputs When Configured as MUX

The Digital outputs are configured as 16 output pins shown below.

The output pins are used such that pins 16 through 9 contain sequenced binary codes (always active high) containing each of the STATIC available data other than the OUTPUT INVALID code. Pins 8 through 5 contain a binary code (active high) indicating the data present on pins 16 through 9. Pin 4 is a pulsed clock signal at least 100ns wide, with both leading and trailing edges at least 100ns within the stable period of the other digital outputs. The address (pins 8-5) and the data (pins 16-13 and 12-9) are as follows, see above for a description of each data output format. Addresses not listed below are reserved for future use.

Address 0 : LOAD CODE A (pins 16-13) and LOAD CODE B (pins 12-9).

Address 1 : LOAD CODE C (pins 16-13) and LOAD CODE D (pins 12-9).

Address 2 : LINE SOURCE ENABLE (pins 16-13) and LINE SWITCH ENGAGE (pins 12-9).

Address 3 : FILAMENT ENGAGE (pins 16-13) and TUBE ENGAGE (pins 12-9).

Address 4 : TESTING (pins 16-13) and RESULTS 1 (pins 12-9).

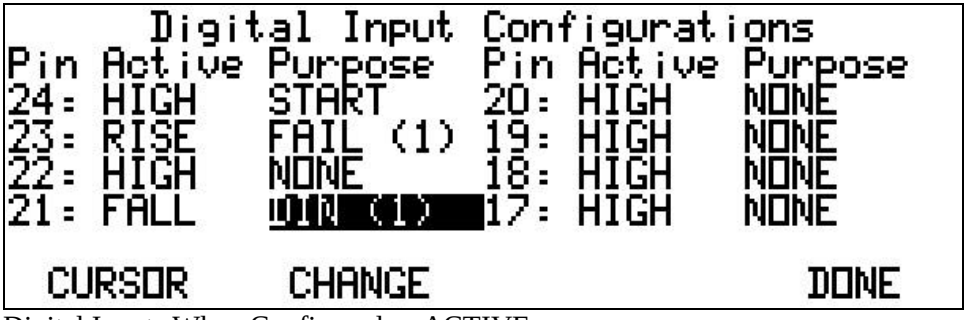
Address 5 : RESULTS 2 (pins 16-13) and RESULTS 3 (pins 12-9).

Address 6 : RESULTS 4 (pins 16-13) and TEST FAIL (pins 12-9).

Address 7 : TEST STEP CODE (pins 16-9)

Address 8 : WAIT FAIL (pins 16-13), pins 12-9 are undefined

DIGITAL INPUTS


Digital Input Configurations
Pin Active Purpose Pin Active Purpose
24: HIGH START 20: HIGH NONE
23: RISE FAIL (1) 19: HIGH NONE
22: HIGH NONE 18: HIGH NONE
21: FALL 17: HIGH NONE
CURSOR
CHANGE
DONE

Digital Inputs When Configured as ACTIVE

The eight digital input pins (pins 24-17) may be independently configured to one of the following selections when detected as being active.

Each input may be selected as active when HIGH (logic ‘1’), LOW (logic ‘0’), RISE (transitions from logic ‘0’ to logic ‘1’) or FALL (transitions from logic ‘1’ to logic ‘0’).

Each input configured for HIGH or LOW active detection must remain at the configured level for at least 5ms.

Each input configured for RISE or FALL active detection must remain at each logic level for at least 5ms.

1. **START.** Causes the 2574R to start the test procedure. If this signal remains active after the test is completed then no further testing can be initiated until the signal returns to the unasserted condition. If multiple inputs are configured for this purpose, then all must be active for the test sequence to be started (i.e. multiple inputs are AND'ed). This configuration is ignored on slave 2574R's.
2. **DIGITAL INPUT 1,2,3** or **4.** Causes the 2574R to continue an INTERACTIVE WAIT test step, or to change a test procedure during an IF type test step that has been configured to use this input. If multiple inputs are configured for this purpose, then all must be active for the test sequence to be continued (i.e. multiple inputs are AND'ed). This configuration is ignored on slave 2574R's.
3. **ABORT.** Causes the 2574R to abort any running test procedure. If multiple inputs are configured for this purpose, then any assertion will cause the test sequence to be aborted (i.e. multiple inputs are OR'ed). Note that a test sequence cannot be started if this signal is active. This configuration is ignored on slave 2574R's.
4. **HOLD.** Causes the 2574R to hold any running test procedure. If multiple inputs are configured for this purpose, then any assertion will cause the test sequence to be held (i.e. multiple inputs are OR'ed). Note that a test sequence cannot be started if this signal is active. When held asserted on slave 2574R's running a test sequence this effectively prevents the affected 2574R from participating in the test procedure being run by the controlling 2574R, all results taking the NOT MEASURED status for the affected instrument.
5. **FAIL 1,2,3,4** or **ALL.** Causes the 2574R to immediately critically fail (External Failure) the specified ballast (or all ballasts). If multiple inputs are configured for this purpose, then any assertion will cause the test sequence to be failed (i.e. multiple inputs are OR'ed). Note that a test sequence cannot be started if any of these signals are active.
6. **RECALL b0,b1,b2,b3** or **b4.** Causes the 2574R to recall the specified configuration store number formed by the complete 5-bit binary code. Bits that have not been configured for this purpose are considered as being unasserted. If set for code 00000 then no store recall is performed (store #0 is invalid), and a recall is only performed when the code recognized as having been changed. This configuration is ignored on slave 2574R's.
7. **INVALID.** This may be used to prevent unwanted side effects from slowly changing digital signals on the other inputs. If multiple inputs are configured for this purpose, then any assertion will cause the inputs to be ignored (i.e. multiple inputs are OR'ed).

Digital Inputs when configured as OFF

All inputs are ignored.

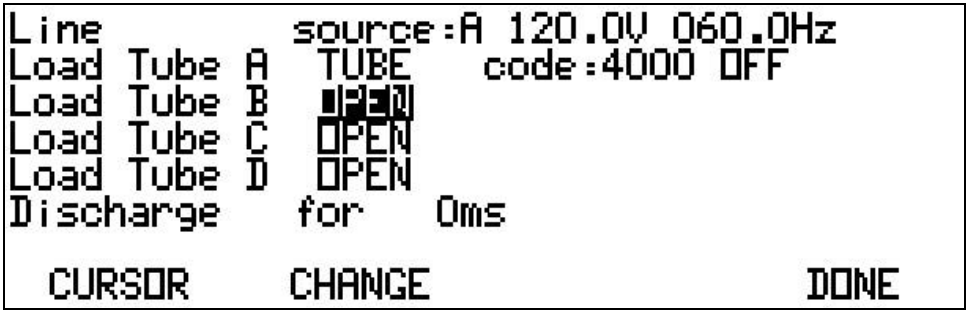
Ethernet Interface

When this option is not fitted, this is set for Inactive and cannot be altered.

Configuring Ballast Line & Loading

This menu item is only available in the General Purpose mode.

This menu allows you to configure the line voltage and frequency, and the ballast loading to be used while using the General Purpose mode of the 2574R.



Line Settings

This allows the user to configure the line conditions required.

First time users may disregard these settings.

LINE SOURCE SELECTION

This is only used if the 2574R is controlling a 1500 chassis or for Digital Output control.

This allows the user to specify which of up to four line sources are to be used (A, B, C or D). If the 2574R is configured to control one or more 1500 chassis, then an error message is displayed if the selected source does not have a corresponding switch in a 1500 chassis.

LINE VOLTAGE

This is only used if the specified source is under the control of the 2574R.

The F3-PRESET key may be used to select common line voltage settings.

LINE FREQUENCY

This is only used if the specified source is under the control of the 2574R.

The F3-PRESET key may be used to select common line frequency settings.

Load Settings

This allows the user to configure the ballast output loading for each tube. The letter designation corresponds to the section letters on the 2574R rear panel.

First time users should set each load section being used as **TUBE** type, with code **0000** and selected as **ON**. Unused load sections should be set to **OPEN**.

LOAD TYPE

This may be *OPEN, TUBE* or *AUTO*.

If set to *OPEN* then the 2574R makes no assumptions regarding the loading for this ballast output.

If set to *TUBE* the 2574R assumes that an actual tube load is being used on this ballast output and the tube strike detection is performed accordingly. Glow, Transition and Strike detection of the ballast are performed using the real time measurements of tube current (see STRIKE DETECTION). Real time filament preheat measurements may be made using filament voltage, current and/or power measurements or using the tube strike timing, as desired (see PREHEAT DETECTION).

If set to *AUTO* then the 2574R attempts to control the loading on this ballast output using the load code and state described below. Strike detection of the ballast is performed using the real time measurement of peak tube voltage (see STRIKE DETECTION). Real time filament preheat measurements may be made using filament voltage, current and/or power measurements or using the tube strike timing, as desired (see PREHEAT DETECTION).

LOAD CODE

This is only available for loads not selected as OPEN.

This is a 4-digit number describing the load to be selected by a 1500 chassis. The F3-SELECT key may be used to view a scrollable list of available load codes and descriptions. From within this sub-menu, the user may select any of the detected load selections. If the code is *0015* or less, then this inhibits any error messages if the load is not found in a 1500 chassis, allowing the user to select multiple loads using the Digital I/O interface output signals.

LOAD STATE

This is only available for loads not selected as OPEN.

This may be *OFF*, *FIL* (filament only), *ON* (filament and tube load) or *AUTO* (automatically selected dependent on the strike condition). For a 2-pin load module, the *FIL* and *OFF* selections are identical. Only the *OFF* and *ON* selections are available for a *TUBE* type load.

If set for *AUTO*, then the actual loading is either *FIL* (prior to strike and when unpowered) or *ON* (following strike).

Ballast Discharge Period

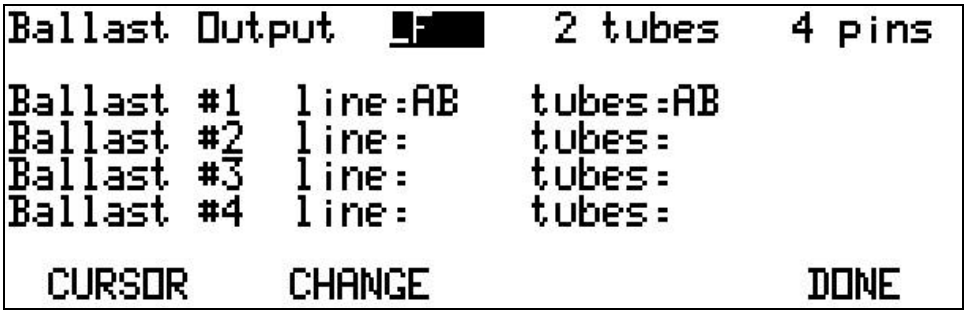
This setting only applies to AUTO loading.

This allows you to set the length of time that the full loading (when using AUTO load type) will be held after removing line power to the ballast. Some ballasts require that the load be maintained after power is removed to ensure that the output stage is fully discharged.

Configuring the Ballast Type & Wiring

This submenu allows you to configure characteristics regarding the ballast and ballast wiring to the 2574R.

First time users should carefully configure these settings according to the ballast being tested.



Ballast Type

BALLAST OUTPUT FREQUENCY

The frequency range of the ballast output (either low or high frequency). Use the *LF* setting if the ballast output is below 2KHz; use the *HF* setting if the ballast output is above 5KHz.

NUMBER OF TUBES

The number of tubes actually driven by the ballast. Not all tubes need be measured by the 2574R, see ***Ballast Wiring*** below. If less than this number of tubes are configured to be measured, then the 2574R automatically multiplies the total power measured in the configured tubes to obtain an estimate of the actual total output power of the ballast.

NUMBER OF PINS PER TUBE

This selection is not available for options QS or HID.

The number of pins per tube actually driven by the ballast. Note that if you select *2 Pins*, then all filament results are disabled. You may separately select whether the loads have 2- or 4-pins (see below).

Ballast Wiring

Four display lines allow you to select how each of the ballasts and loads are physically connected to the 2574R line and tube measurement sections. See also the ***Ballast Test Connections*** section later in this document.

LINE WIRING

This allows the user to specify which rear panel line section(s) is/are used for the line measurements for each ballast. Ballasts for which no line wiring is specified are disabled. If multiple sections are wired for single ballast, then the current signals are automatically vector added to obtain the actual ballast line current.

LOAD WIRING

This allows the user to specify which rear panel line section(s) is/are used for the load measurements for each ballast. Ballasts for which no load wiring is specified do not have any load measurements made.

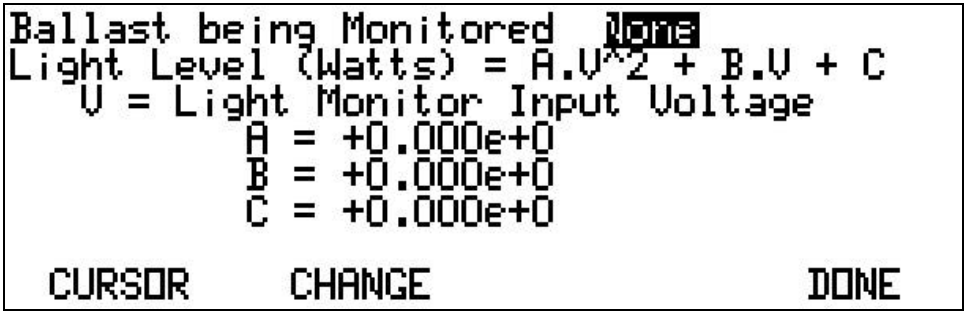
LOAD PINS

This selection is not available for options QS or HID, and is not available if the Number of Pins per Tube setting is 4-pins.

This allows the user to specify whether a 2-pin ballast is being loaded with a 2-pin or 4-pin load.

Configuring a Light Monitor

This submenu allows you to configure a light monitor.

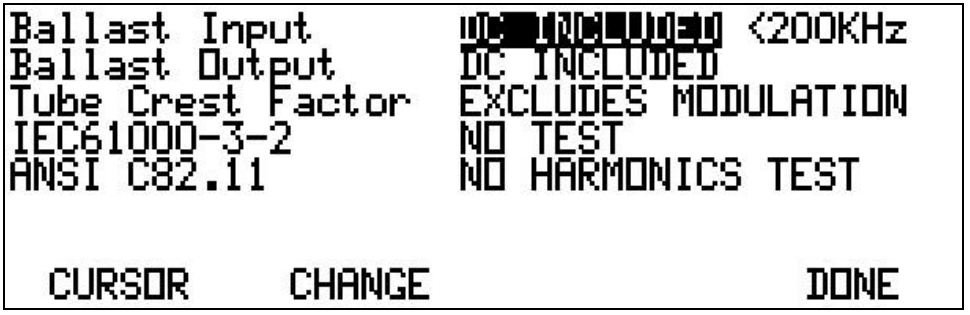


It is recommended that first time users disable the light monitor capability by setting the ballast to **None**.

You may select which ballasts' tubes light level is being monitored, and the linearization coefficients of the light monitor.

Configuring Measurement Options

This submenu allows you to configure details regarding how measurements are made.



Ballast Input Signal Content

You may select whether any DC line content is to be included (or not), and whether line measurement bandwidth is to be 5KHz or 200KHz. Note that the bandwidth setting can considerably influence the peak line inrush current measurements.

It is recommended that first time users set **DC INCLUDED** and **<5KHz** bandwidth.

Note that the line current measurement devices are Hall-Effect type transducers. These have some temperature dependency regarding their DC offset, the use of DC Offset correction is recommended (see page 26) when set for DC Included.

Ballast Output Signal Content

You may select whether any DC content is to be included (or not) in ballast output measurements.

It is recommended that first time users set **DC INCLUDED**.

Ballast Output Crest Factor Measurements

This is ignored for ballasts configured as LF in the Ballast Type & Wiring menu.

You may select whether to include the effects of output modulation (or not) in the measurements of tube voltage and current crest factor.

It is recommended that first time users set **INCLUDE MODULATION**.

IEC61000-3-2

You may select whether to perform IEC61000-3-2 Class C testing (or not). If IEC61000-3-2 testing is selected then all line harmonics measurement are made over 16 cycles of line, thus harmonics testing speed (and bandwidth) is considerably affected by this selection. The 2574R does not check whether the line power level is above the minimum level for class C testing.

It is recommended that first time users set **NO TEST**.

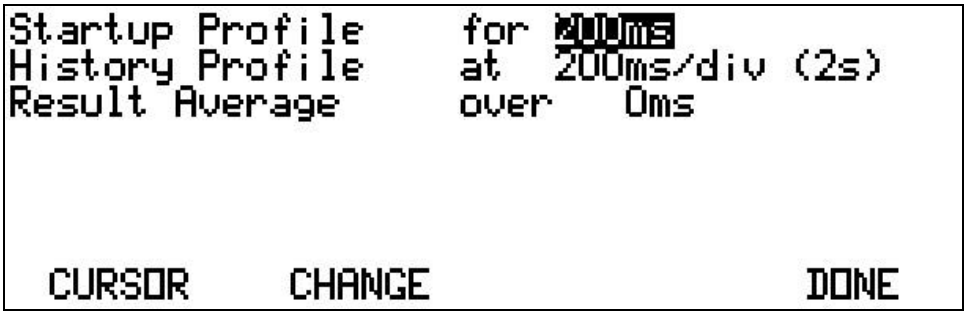
ANSI C82.11

You may select whether line current harmonics testing to the requirements of ANSI C82.11 is to be made available (or not).

It is recommended that first time users set **NO HARMONICS TEST**.

Configuring Measurement Timing

This submenu allows you to configure the timing used to obtain measurement results.



Startup Profile

You may select the period over which to profile the ballast line and output results following initial application of power to the ballast. Note that if line power is manually removed (i.e. not using the 2574R commanded line switching) during this period then the strike and preheat measurement results may be made invalid.

It is recommended that first time users set this to between 1 second and 10 seconds, according to the expected strike and stabilization time of the tube loads and ballast.

History Profile

This display line is only present if the General Purpose mode is selected.

You may select the rate at which to profile ballast line and output results for historical data logging purposes.

It is recommended that first time users set this to a rate of 1 second per division or longer.

Sequence Profile

This display line is only present if the Test Sequence mode is selected.

You may select the period over which to profile the ballast line and output results following starting a test sequence.

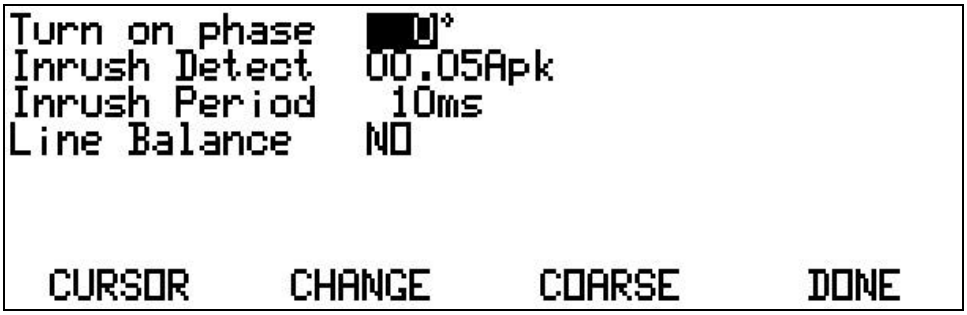
Result Average

You may select the period over which the 2574R averages measurement results. This setting does not affect any profiled data or measurements obtained. When using a high frequency ballast, this should be set to a minimum of 5ms (output modulation <5%), 10ms (output modulation <10%), or 20ms or more (output modulation >10%). The value chosen is the time constant of settling of measurement results.

It is recommended that first time users set this to **20ms**.

Configuring Line Inrush Detection

This submenu allows you to configure the levels and timing used to apply line power to the ballast and to detect line
inrush.



Start Phase

This is only used if supported by the 1500 chassis being used for the specific line source and ballast.

You may select the line voltage phase at which all unpowered to powered transitions are to occur. This may be selected between 0° and 359° in 15° (*COARSE*) or 1° (*FINE*) increments.

First time users should disregard this setting.

Inrush Detection Level

You may set the peak line current, which, if exceeded, signifies the start of line inrush.

Setting this at too high of a value may cause the 2574R to never detect the initial application of power to the ballast, setting this too low may cause false detection caused by noise. A level between 50mA and 500mA is recommended in most circumstances. First time users should use a setting of 0.1Apk, unless a very low power ballast is being used, in which case this should be reduced.

Inrush Period

You may select the period over which line inrush is expected to occur. The 2574R automatically disables all other measurements during this period to ensure that measurements are not affected by transients occurring at this time.

It is not recommended to set this above 20ms unless specifically desired, as the ballast output timing and strike detectors are disabled during this period.

It is recommended that first time users set this to **20ms**.

The following notes apply –

1. This period may be extended by Line Balance Detection (see below). If this occurs, only the inrush period is extended, not the period for which ballast output timing measurements are disabled.
2. If a value of less than 20ms is configured then the inrush measurements are performed over 20ms, but the ballast output measurements are disabled for the configured time. I.e. inrush measurements have a minimum of 20ms period enforced.
3. This period starts when either –
   General Purpose Mode: A startup profile is not being collected and the peak line current changes from less than the detection level to more than the detection level in consecutive half line cycles.
   Test Sequence Mode: An INRUSH test step is started, followed by any half line cycle peak line current of more than the detection level.
4. For ballasts that consume zero line current at times during the striking of the tube, the user must ensure that the startup profile period is sufficiently long to ensure that all such events are included. Otherwise a second inrush detection will occur yielding erroneous inrush and strike measurements.
5. The configured inrush period may be longer than the configured startup profile period if desired, however this would be highly unusual.

Line Balance Detection

You may select whether to wait for line balance and the percentage balance required. If enabled, the line inrush period is extended until either the percentage difference in the measured positive and negative peak line current is less than the configured limit or the configured timeout has expired (see below).

It is recommended that first time users disable this setting.

LINE BALANCE PERCENTAGE

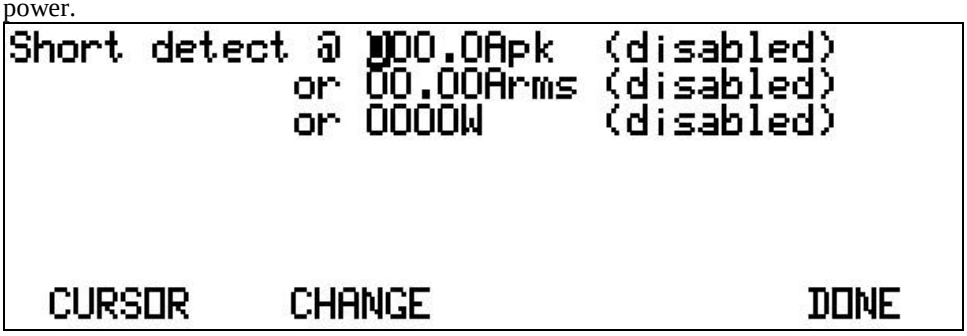
The percentage balance is the maximum percentage imbalance between consecutive positive and negative peaks of line current before continuing. This is selectable in the range 1% to 50%.

LINE BALANCE TIMEOUT

You may select the maximum length of time that the 2574R will wait for line balance to be detected. After the expiration of this time the 2574R continues as if line balance had been achieved. This selection is only available if line balance detection has been enabled.

Configuring Line Short Detection

This submenu allows you to configure the 2574R to detect a short-circuit ballast or a ballast that consumes excessive line
power.



If supported by the configured line source being controlled by the 2574R, the line source is also polled to detect any tripping of its internal current limit. Any such trip is also detected as a shorted ballast. All ballasts configured as being powered by the affected line source are flagged in this situation.

It is recommended that first time users set each detection level to zero to disable line short detection.

Short Apk Detection Level

This setting allows the user to set the maximum peak line current that the ballast may draw from the line at any time. Setting this to a value of 0 disables this detection. If this value is set higher than the maximum measurable peak current, then the maximum measurable value is used.

Short Arms Detection Level

This setting allows the user to set the maximum RMS line current that the ballast may draw from the line at any time other than the initial inrush period after application of line. Setting this to a value of 0 disables this detection. If this value is set higher than the maximum measurable RMS current, then the maximum measurable value is used.

Short Watts Detection Level

This setting allows the user to set the maximum line power that the ballast may draw from the line at any time other than the initial inrush period after application of line. Setting this to a value of 0 disables this detection. If this value is set higher than the maximum measurable watts, then the maximum measurable value is used.

Action When Shorted Ballast is Detected

This selection is only available when the 2574R is configured in Test Sequence mode. In the General Purpose mode an error message is temporarily displayed on the front panel when this occurs (this is maintained if the 2574R can take no remedial action).

This setting configures the 2574R for the action to take regarding any other ballasts being tested at the time that a shorted ballast is detected.

The available selections are –

1. **ABORT**. All test sequences on the unaffected ballasts are aborted and flagged as aborted (unless already flagged as failed). The test sequence proceeds immediately to the END step.
2. **RETEST**. This is only effective if the ballasts have individual line switches being controlled by the 2574R. If this is selected, then the entire test procedure is restarted from step #1, but without the affected ballast being tested. The user may configure a delay between removing all power from the ballasts until restarting the tests on the unaffected ballasts.

Configuring Strike Detection

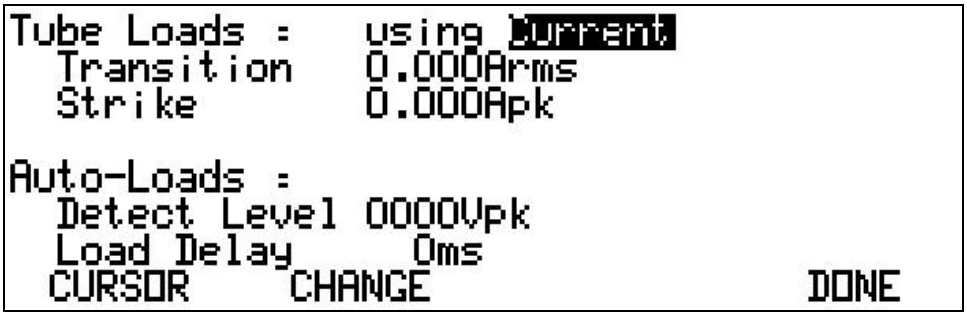
This submenu allows you to configure the levels used to detect tube strike.

This menu is in two sections. The first section allows the user to configure the levels at which the 2574R will detect transition and strike when using actual tube loads. The second section allows the user to configure strike detection when using resistive timed loads.

TUBE Load Strike Detection Configuration

DETECTION METHOD

The 2574R can be configured to detect tube strike by either current or power measurements.



The use of current measurements has been the standard for some time, but this method can be seriously compromised by capacitive current flow and CMRR measurement errors. Particularly with high voltage (e.g. HID) and/or high frequency ballasts, there may be large RMS or peak current flows from the ballast prior to strike of the tube. This can seriously detract from the accurate detection of tube strike. The 2574R allows the user to use actual total tube power as the method for detecting strike and transition if desired. This method virtually eliminates these errors.

It is recommended that first time users set this to **Current**. Note that these settings cannot prevent the 2574R from making any of the standard measurements. These settings only affect the strike and preheat detection systems.

TRANSITION LEVEL

You may set the RMS current or power (see above) level in the tube, which if detected at a higher level than the configured level, is detected as the start of transition from glow to strike. With regard to ANSI C82.11, this should typically be set to 9% of the nominal tube operating current. When using power detection, 25% of the nominal operating tube power is recommended (note that the total tube power is used, this includes filament power). This level must be achieved before the full strike detection is enabled; thus, this setting should not be higher than the TUBE STRIKE detection setting.

It is recommended that an initial setting of 0.05Arms be used.

TUBE STRIKE

You may set the peak current level, or the total tube power, which if sustained at a higher level than the configured level, is detected as the completion of tube strike. Note that is the value set is too high, then the tube may never be detected as being struck by the ballast. If unsure of this setting, initially use a value that is known to be low enough. When using power detection, 90% of the nominal operating tube power is recommended (note that the total tube power is used, this includes filament power).

It is recommended that an initial setting of 0.2Apk be used, then the startup profile can be used to obtain a more useful level for strike detection if desired.

AUTO Load Strike Detection Configuration

STRIKE OUTPUT

You may set the ballast output peak voltage level that must be initially achieved before starting the delay prior to engaging the primary tube load. Note that if this value set is too high then strike detection may never occur. If unsure of this setting, initially use a value that is known to be low enough.

When initially using AUTO loads (e.g. with a 1500 load chassis), a value of 300Vpk is recommended. Higher settings may be used if it is known that the ballast outputs a higher peak strike voltage.

LOAD DELAY

You may set the delay before engaging the primary tube load after detecting a ballast output peak tube voltage exceeding the configured peak voltage strike detection level. This setting simulates the delay that an actual tube exhibits before striking after being driven by a striking voltage.

When initially using AUTO loads (e.g. with a 1500 load chassis), a value of 100ms is recommended.

Configuring Preheat Detection

This submenu allows you to configure the timing or levels used to obtain filament preheat measurement
results.

First time users are recommended to select the **Pre-Strike Period** selection, this selects that the filament preheat measurements are made with the strike detection system.

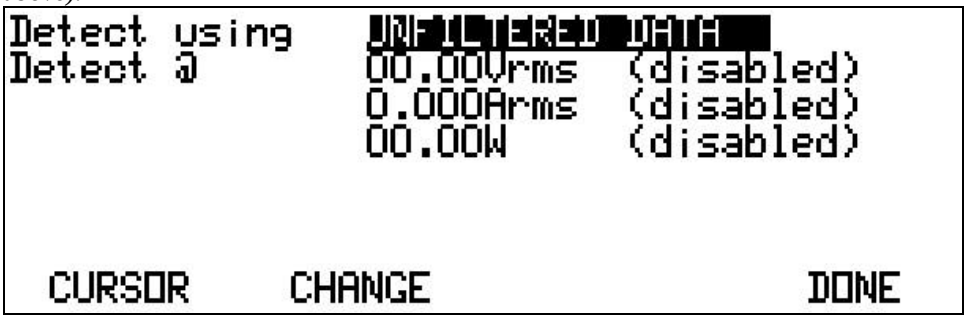
Preheat Detection Method

The following selections are available -

1. **Pre-Strike Period.** If this is selected then the preheat period is taken as the period between the detection of the starting of ballast output until the detection of transition or strike.
2. **Using unfiltered levels.** If this is selected then the unfiltered real-time measurements of each filament are used to detect filament preheat. This method yields the best timing resolution.
3. **Using Averaged levels.** If this is selected then the averaged measurements of each filament are used to detect filament preheat. This method yields poor timing correlation to tube strike, but can be used with ballast having a large amount of output modulation.

Voltage, Current and Power Detection Levels

These selections are only available if Pre-Strike Period was not selected as the detection type (see above).



Setting any of these to zero disables that particular detection. Filament preheat measurements are started when any enabled signal is above the respective level, and is terminated when all enabled signals are below these levels.

Printing Configuration Details

Press the PRINT button while the **Configuration** screen is displaying to obtain a report containing the selected mode and all the configuration choices you have presently selected.

A textual or PCL2 printer is required for this operation.

Configuring a Test Sequence

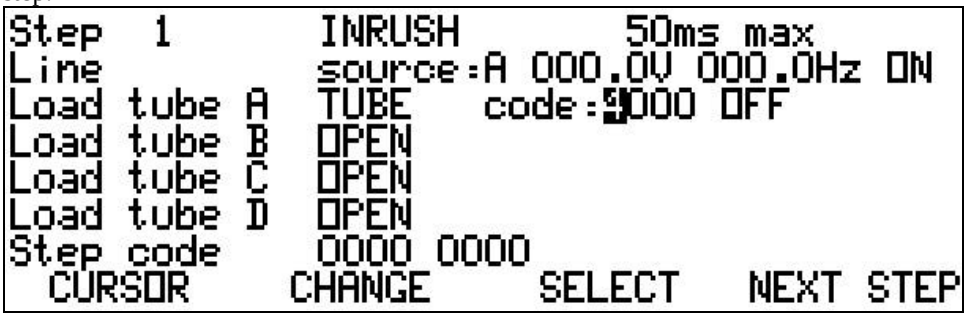
This submenu allows you to configure the complete test sequence to be performed on a step by step basis.

Initially step #1 is always displayed, you may use the F4-STEP XX key to select the next step for display and/or editing. Editing of test steps is completed, and the changes saved, when either an END test step is edited, or the NEXT key is pressed while using this menu.

A complete test sequence may contain up to 99 test steps.

All configured ballasts perform the same test procedure simultaneously, starting at step number 1. The only exceptions to this is the INRUSH step, which is sequentially performed on each ballast in turn. The sequence continues performing test steps when all ballasts have completed their test steps.

The following paragraphs describe the configuration available for each test step.


Step 1 INRUSH 50ms max
Line source:A 000.0V 000.0Hz ON
Load tube A TUBE code:0000 OFF
Load tube B OPEN
Load tube C OPEN
Load tube D OPEN
Step code 0000 0000
CURSOR CHANGE SELECT NEXT STEP

Notes for First Time Users

When initially using the Test Sequence mode the user is recommended to use the simplest possible test sequence to gain experience. Assuming the use of a 1500 chassis, the following sequence is recommended.

1. INRUSH. This applies power to the ballast, using a line switch in the 1500 if available. The user should set the desired line voltage and frequency (if controlled) and set that line is ON. Ballast loading should be set for AUTO loads, using the code for the desired loading, using an AUTO state.
2. WAIT STRIKE. This waits for the ballast to apply and hold the configured strike voltage. The same line and load settings should be used as for the INRUSH step above.
3. CHECK. This should be configured to initialize the result averages, wait for a period of time (a few hundred milliseconds is recommended), then apply limits to measurement results. When deciding what limits to apply don't forget to set the limits as described later.
4. If more than one area of measurements are to be checked (e.g. line current and tube power) then more than one CHECK step may be required. Additional CHECK steps should be used following the first one (above), configured to not initialize result averages, and with no delay.
5. END.

Defining the Step Type

This selects the type of step that is to be performed at this point in the sequence. The available selections and a description of the activities performed are as follows.

INRUSH STEP TYPE

This step enables inrush detection (and line balance detection if configured), clears the startup profile and initializes all tube preheat and strike timing & level measurements. A timeout may be configured, which if exceeded causes the detection of an OPEN BALLAST failure, otherwise this test step is completed when the configured inrush period expires (following line current detection), and extended by the line balance detection if enabled.

The following notes apply –

1. More than one **INRUSH** test step can be present in a test sequence. Each application of line power to the ballast should have an **INRUSH** test step.
2. Configuring an **INRUSH** step with a line switch state of *OFF*, or a line voltage of 0Vrms with a controlled line source, may yield undesired results.
3. Setting a timeout value of zero disables the timeout. This can result in test sequence lockup if an open ballast is tested, requiring the user to abort the test manually.
4. Any test steps performed prior to this step will not be included in the startup profile data. Generally, only **DELAY** steps would be found prior to the first **INRUSH** step, these being used to pretest the ballast line input for short circuits prior to fully powering the ballast.
5. All tube strike and filament preheat measurements are both initialized and enabled by the action of an **INRUSH** step. Following strike and/or preheat measurement completion these results are held until another **INRUSH** step is executed.

DELAY STEP TYPE

This step enables the user to insert a delay period into a test sequence. Typically, this would be used to enforce delays to allow the line source to settle, or for performing low voltage pretests on ballasts. The user may specify delay periods between 5ms and 30 minutes.

WAIT STRIKE STEP TYPE

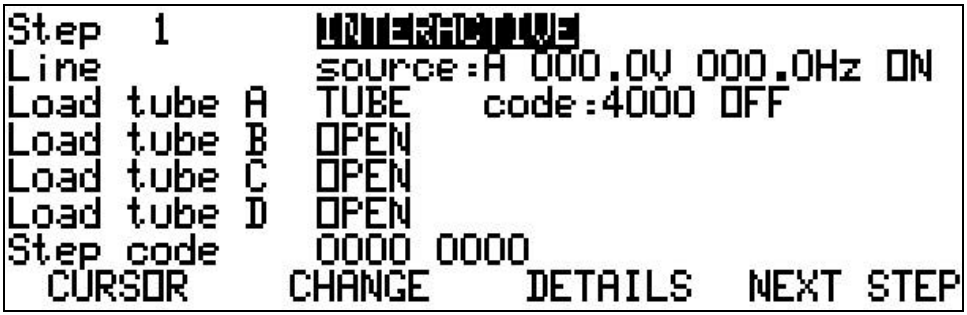
This step enables the user to program that the test sequence holds until ballast strike has been detected. All tubes on all ballasts must have achieved strike prior to this step being completed. The user may specify both a minimum and maximum time for this type of test step, with periods between 0ms and 30 minutes.

In the case of resistive loads, strike is detected for each ballast output following the expiration of the configured delay time, following the detection of the configured strike voltage.

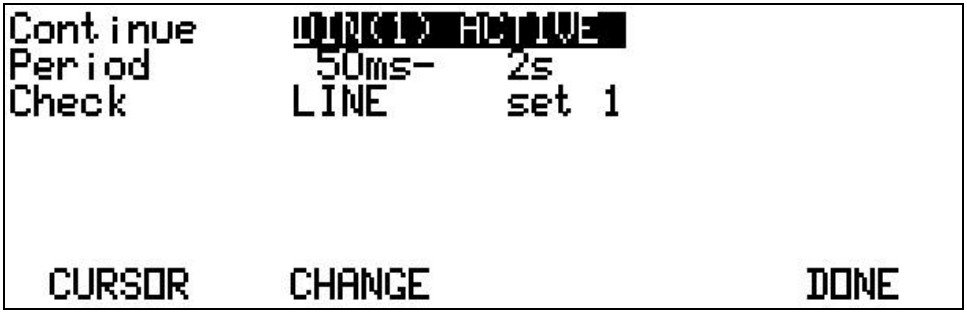
In the case of tube loads, strike is detected for each ballast output following initial detection of the configured strike current.

INTERACTIVE STEP TYPE

This step enables the user to program a pause in the test sequence, waiting for an external event to occur (using a specifically configured digital input) or for user adjustments to have been made.


Step 1 INTERACTIVE
Line source:A 000.0V 000.0Hz ON
Load tube A TUBE code:4000 OFF
Load tube B OPEN
Load tube C OPEN
Load tube D OPEN
Step code 0000 0000
CURSOR CHANGE DETAILS NEXT STEP

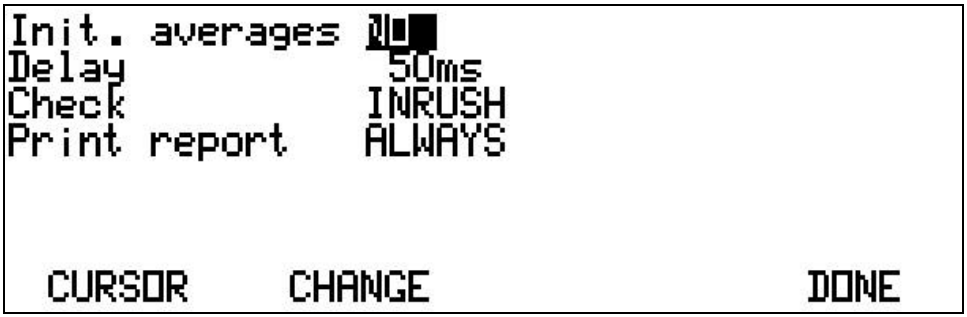
The user may specify both a minimum and maximum time for this type of test step, with periods between 0ms and 30 minutes.



The user may specify a set of results to check while waiting (see the **CHECK** step description below). If configured, the actively checked results configured are displayed in a specific INTERACTIVE ACTION screen, together with the pass/fail status of those results. Any failure during this step is ignored. The F3-CONTINUE softkey can be used to manually complete this test step, or a digital input pin can be used.

CHECK STEP TYPE

This step enables the user to program that specific measurements taken on the ballast are to be compared against user set limits.



The user may also specify to initialize the measurement result averages at the beginning of the step.

The user may configure a delay of between 0ms and 30 minutes prior to performing the actual test limits checks.

The user may also configure, independently for each CHECK step, whether the results will be included in a test report printed after completion of the test sequence. Each CHECK step should have this set to NEVER REPORT if no automatic report printout is desired (the user may still manually command one using the PRINT key in the Test Summary or Detailed Results screens).

The available check limit collections are as follows, if more than one group of selections is required then more than one **CHECK** step should be used.

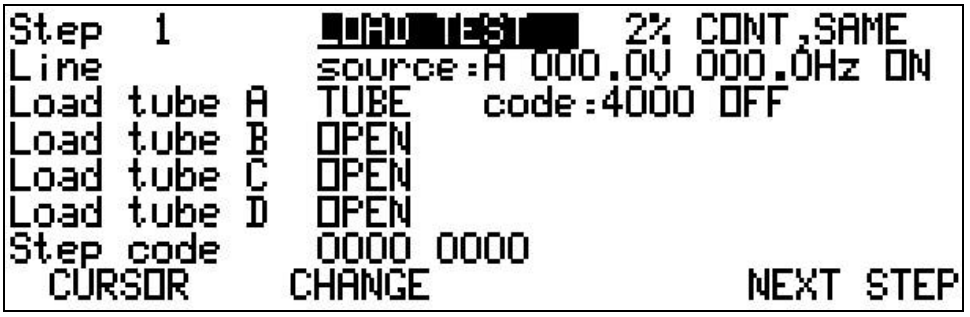
- **INRUSH**. One set of limits is available.
- **PREHEAT 1,2 or 3**. Three sets of preheat levels and timing limits are available.
- **STRIKE 1,2 or 3**. Three sets of glow and strike levels and timing limits are available.
- **LINE 1 through 9.** Nine sets of line current, power and harmonics (including IEC1000-3-2 and ANSI C82.11) level limits are available.
- **TUBE 1 through 9**. Nine sets of tube voltage, current, filament voltage, current, power level limits are available. For this set of checks the same limits are applied to all configured tubes (see also **SECTION** below).
- **SECTION 1 through 9**. Nine sets of four tube voltage, filament voltage, power and frequency limits are available. For this set of checks, the limits are applied to a user specified specific tube section, which need not have been configured in any specific ballast.
- **OVERALL 1 through 9**. Nine sets of total power, power loss and power efficiency limits are available.
- **PHASING**. One set of filament-tube relative phasing limits is available.

Note the following –

1. Selecting to initialize the averages and selecting a delay of zero may result in unwanted results, a delay of at least 3 times the configured result average period is recommended.
2. This test step also serves to save the measurements and perform statistics for the specified result collections for interface retrieval and data reporting.
3. The same sets of limits are available for the **INTERACTIVE WAIT** steps also, but no measurements are saved for this type of test step.
4. Each limit may be programmed (see the **TEST LIMITS** configuration details later in this document) for the action to be taken (*IGNORE, REPORT ONLY, CONTINUE IF FAIL*, or *STOP IF FAIL*) and the limits to apply.
5. If the user wishes to check measurement results in several areas, then several CHECK steps may be needed. The additional CHECK steps should follow the first one, but set to not initialize result averages, and with no delay.

LOAD TEST STEP TYPE

This step enables the 2574R, in conjunction with a configured 1500 chassis, to check that the configured load resistances are valid. This step type is ignored if configured for tube loads.



The user may specify the percentage limits for the measured load resistance values. It is expected that this step will be performed when the ballast has settled with full loading, performing this step at any other time may lead to undesired results.

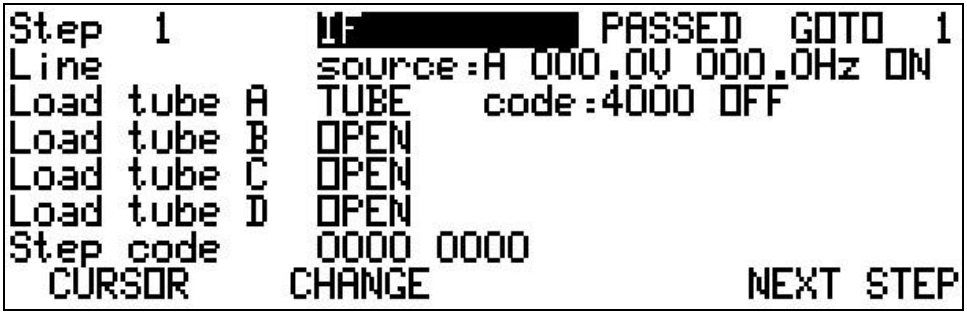
The user may specify the action to take if the load is found to be outside of the allowed tolerance.

- **CONT SAME**. The remainder of this test sequence is performed with the originally selected specified load; this load is flagged as failed at the end of the entire test sequence, or when deselected in the sequence.

- **CONT ALT**. The load is changed without otherwise altering the ballast and the remainder of this test sequence is performed with an alternate load. The failed load is immediately flagged as failed. The user may select whether to use open-then-close or close-then-open switch timing when performing this type of change from the 1500 chassis front panel. If no alternate load is found then the action taken will be the same as if the step had been programmed to continue without changing the load.
- **RETEST ALT**. The failed load is immediately flagged and the entire test sequence is repeated. If no alternate load exists for the configured load, then the test sequence will fail due to the lack of suitable load.

IF STEP TYPE

This step enables to user to externally affect the performance of test step in a sequence. Normally the 2574R executes each test step in consecutive sequence, if the selected control signal is active then the next test step performed will be that configured by the user. The following control signals are available.


Step 1 IF PASSED GOTO 1
Line source:A 000.0V 000.0Hz ON
Load tube A TUBE code:4000 OFF
Load tube B OPEN
Load tube C OPEN
Load tube D OPEN
Step code 0000 0000
CURSOR CHANGE NEXT STEP

- **FAIL**. Selects that the selected test step will be the next executed if a non-critical failure has been detected in any ballast.
- **PASSED**. Selects that the selected test step will be the next executed if no failures have been detected in any ballast.
- **DIGITAL INPUT 1,2,3 or 4**. Selects that the selected test step will be the next executed if the selected digital input is detected as being asserted.
- **ALWAYS**. The selected test step is always the next executed.

END STEP TYPE

This test step has no options, and signifies the end of the test sequence. There may be only one **END** step.

Setting the Line Conditions

This allows the user to configure the line conditions for the duration of each step.

LINE SOURCE SELECTION

This setting is ignored if the 2574R is not controlling a 1500 chassis, or if the chassis does not include line source selection switches.

The allows the user to specify which of up to four line sources are to be used (A, B, C or D). If the 2574R is configured to control one or more 1500 chassis, then an error message is displayed if the selected source does not have a corresponding switch in a 1500 chassis.

LINE VOLTAGE

This is only used if the specified source is under the control of the 2574R.

The F3-PRESET key may be used to select common line voltage settings.

LINE FREQUENCY

This is only used if the specified source is under the control of the 2574R.

The F3-PRESET key may be used to select common line frequency settings.

Setting the Ballast Loading Conditions

This allows the user to configure the ballast output loading for each tube for the duration of each step. The letter designation corresponds to the section letters on the 2574R rear panel.

LOAD TYPE

This may be either *OPEN, TUBE* or *AUTO*.

If set to *OPEN* then the 2574R makes no assumptions regarding the loading for this ballast output.

If set to *TUBE* the 2574R assumes that an actual tube load is being used on this ballast output and the tube strike detection is performed accordingly. Glow, Transition and Strike detection of the ballast are performed using the real time measurements of tube current (see STRIKE DETECTION). Real time filament preheat measurements may be made using filament voltage, current and/or power measurements or using the tube strike timing, as desired (see PREHEAT DETECTION).

If set to *AUTO* then the 2574R attempts to control the loading on this ballast output using the load code and state described below. Strike detection of the ballast is performed using the real time measurement of peak tube voltage (see STRIKE DETECTION). Real time filament preheat measurements may be made using filament voltage, current and/or power measurements or using the tube strike timing, as desired (see PREHEAT DETECTION).

LOAD CODE

This is only available for loads not selected as OPEN.

This is a 4-digit number describing the load to be selected by a 1500 chassis. The F3-SELECT key may be used to view a scrollable list of available load codes and descriptions. From within this sub-menu, the user may select any of the detected load selections. If the code is set to *0015* or less, then this inhibits any error messages if the load is not found in a 1500 chassis, allowing the user to select multiple loads using the Digital I/O interface output signals.

LOAD STATE

This is only available for loads not selected as OPEN.

This may be *OFF*, *FIL* (filament only), *ON* (filament and tube load) or *AUTO* (automatically selected dependent on the strike condition). For a 2-pin load module, the *FIL* and *OFF* selections are identical. Only the *OFF* and *ON* selections are available for a *TUBE* type load.

Setting the Step Code for the Digital Interface

This allows the user to assign an 8-bit binary code to the test step. This code may be used to control digital output pins (see the INTERFACE menu description). The code is selected as a 8-digit binary (base 2) numeric; the most significant bit being the leftmost displayed digit.

Setting the Test Limits

This is only available in the Test Sequence mode.

The measurements made by the 2574R are split into logical groups. Each group of measurement results may be checked against limits, and most groups may have several different sets of limits configured. Note the following –

1. The selection of the set of limits for a CHECK or INTERACTIVE WAIT step is independently configured from the actual setting of the limits to apply.
2. Each set of limits may be used in more than one CHECK and/or INTERACTIVE WAIT step.
3. It is recommended that the user print a complete test sequence by pressing the PRINT key (if configured for a printer) when any of the test sequence steps is being displayed. In this manner, the user can check that all required limits have been configured.

To set the limits to apply -

- In the Configuration screen press F1-EDIT.
- Press F1-CURSOR to highlight one of the submenu options shown in the fourth line down.
- Press F2-CHANGE until the submenu you wish to configure displays. This softkey will toggle through the available options, one at a time.

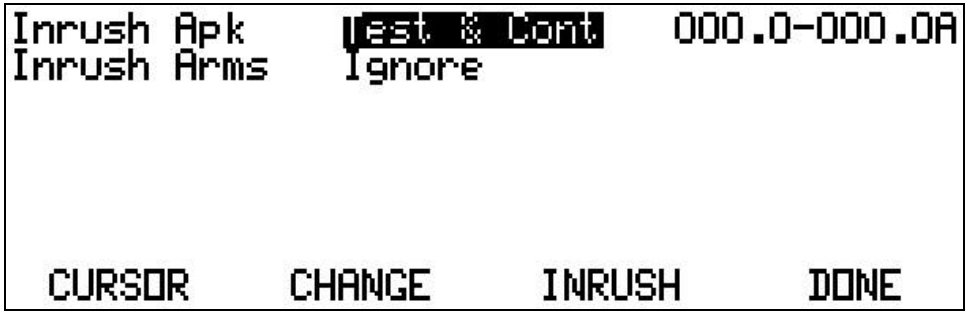
- Press F3-SETUP to open the submenu screen.
- In each screen, the name of the element you are configuring is shown on the left and the selectable settings are shown on the right. Press F1-CURSOR to highlight the settings.
- Press F2-CHANGE to display the various settings for each element.
- Switch between F1-CURSOR and F2-CHANGE, as required. Press the F3-XXXX (e.g. F3-INRUSH, F3-LINE 1, etc.) softkey to change the specific set of checks (if available). Press the F4-DONE key to save the changes and return to the Configuration menu screen.

Each test limit listed is displayed and edited using the same format -

- **Ignore**. Selects that this measurement will neither be checked, nor included in test reports.
- **Report Only.** Selects that this measurement will be included in test reports, but will not be checked against limits.
- **Test & Cont.** or **Test & Stop**. Selects that you want the measurement to be checked and continue testing or stop if it fails to meet the limits provided. The limits against which the result are checked are—
  - If both limits are provided, the result is checked to verify if it lies between the set limits.
  - If only the second limit is provided, the result is checked that it is lower than the set limit.
  - If only the first limit is provided, the result is checked that it is higher than the set limit.

INRUSH Limits

There is one set of limits, accessed by a **CHECK** test step as the *INRUSH* group. These measurements cannot be checked until after an **INRUSH** test step has completed, and are available at any time until an **INRUSH** or an **END** test step is started. This set of limits is not available in an INTERACTIVE WAIT step.



LINE INRUSH LEVELS

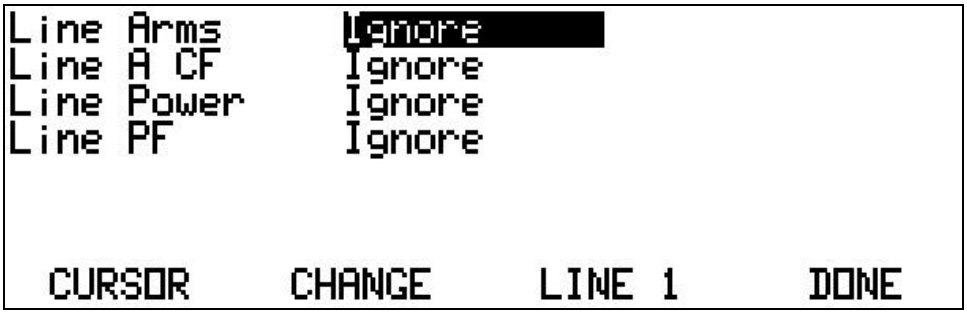
Limits are possible for the measured line RMS and peak inrush current measurements.

LINE Limits

There are nine sets of limits, accessed by a **CHECK** test step as the *LINE 1* through *9* groups. These measurements check against the actual measured values at the time of the **CHECK** test step.

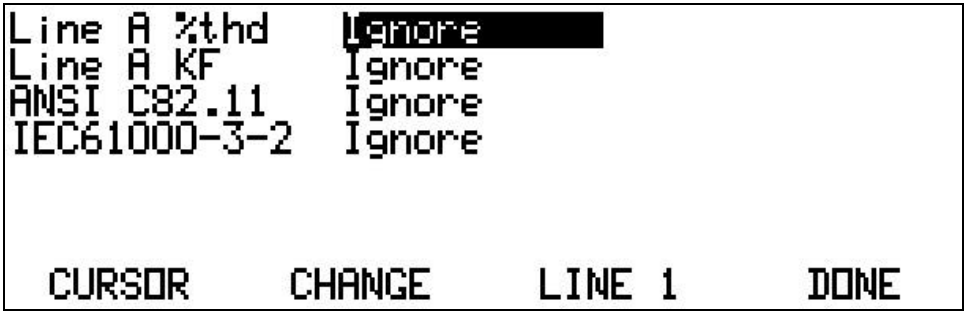
LINE INPUT LEVELS

Limits are possible for the measured line RMS current, line current crest factor, line power and line power factor.



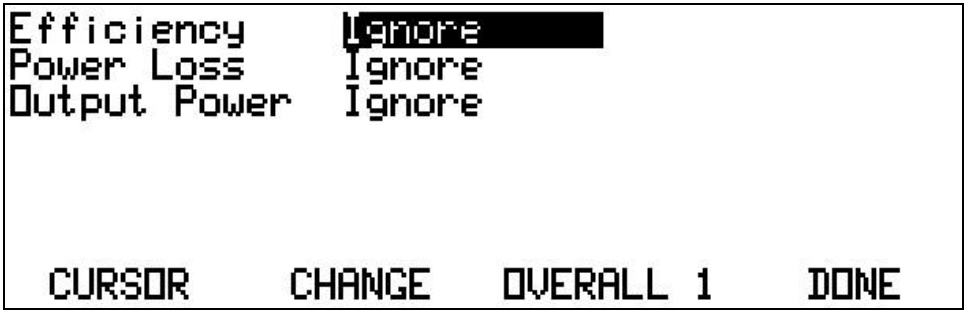
LINE INPUT HARMONICS

Limits are possible for the measured line current distortion, line current K-factor, IEC61000-3-2 Class C tests and conformance to the requirements of ANSI C82.11 harmonics.



OVERALL Limits

There are nine sets of limits, accessed by a **CHECK** test step as the *OVERALL 1* through *9* groups. These measurements check against the actual measured values at the time of the **CHECK** test step.



OVERALL POWER & EFFICIENCY

Limits are possible for the measured ballast efficiency, power loss and total output power.

STRIKE Limits

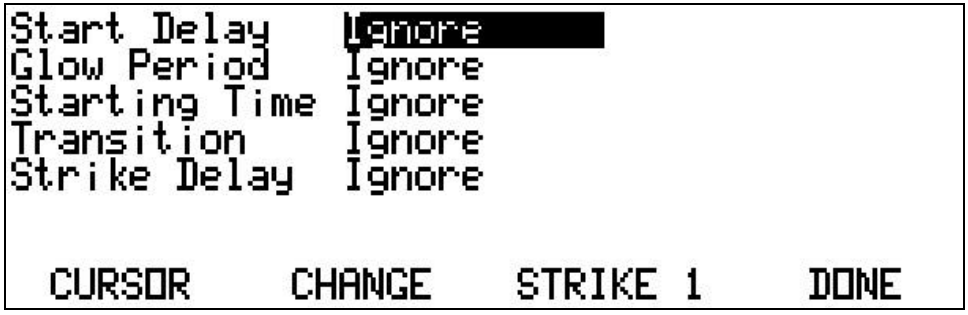
There are three sets of limits, accessed by a **CHECK** test step as the *STRIKE 1* through *3* groups. These measurements cannot be checked until after an **INRUSH** test step has completed and sufficient time has elapsed to ensure that the strike has occurred. The **WAIT STRIKE** test step or a sufficiently long **DELAY** step may be used for this purpose. Measurements are available at any time until an **INRUSH** or an **END** test step is started. All configured tubes are measured against the same limits.

TUBE STRIKE LEVELS

Limits are possible for the measured highest strike voltages (peak and RMS), the mean glow voltage level, crest factor and frequency, the highest post-strike tube current (peak and RMS), and the mean glow current.

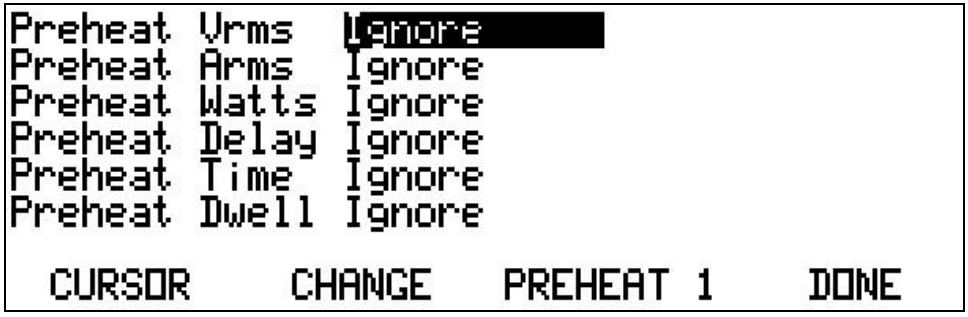
TUBE STRIKE TIMING

Limits are possible for the measured timing of startup delay, glow period, starting period, transition period, and strike delay.



PREHEAT Limits

There are three sets of limits, accessed by a **CHECK** test step as the *PREHEAT 1* through *3* groups. These measurements cannot be checked until after an **INRUSH** test step has completed and sufficient time has elapsed to ensure that the preheat has completely occurred. Measurements are available at any time until an **INRUSH** or an **END** test step is started. All configured filaments are measured against the same limits.



FILAMENT PREHEAT LEVELS

Limits are possible for the measured mean voltage, current and power during the preheat period.

FILAMENT PREHEAT TIMING

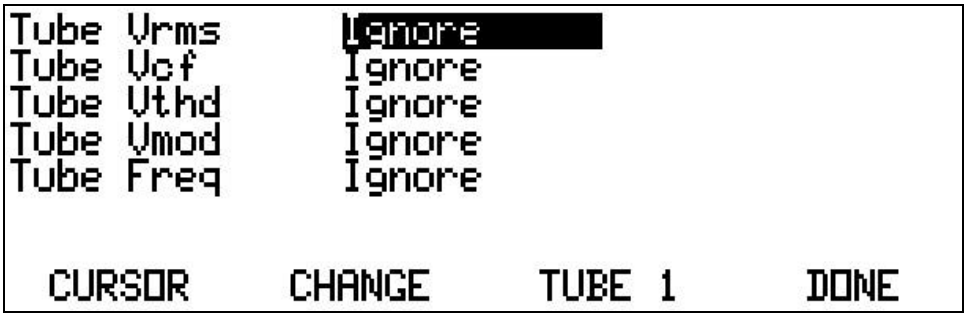
Limits are possible for the measured timing of the period, delay and post-strike dwell.

TUBE Limits

There are nine sets of limits, accessed by a **CHECK** test step as the *TUBE 1* through *9* groups. These measurements check against the actual measured values at the time of the **CHECK** test step. All configured tubes are measured against the same limits.

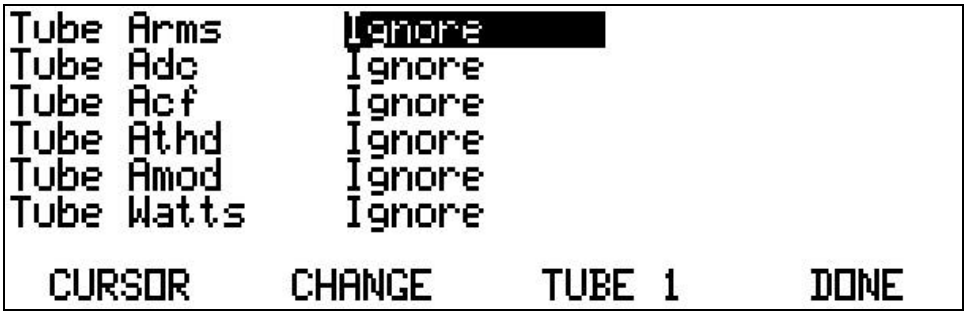
TUBE VOLTAGES

Limits are possible for the measured tube voltage level (RMS), crest factor, distortion, modulation and frequency.



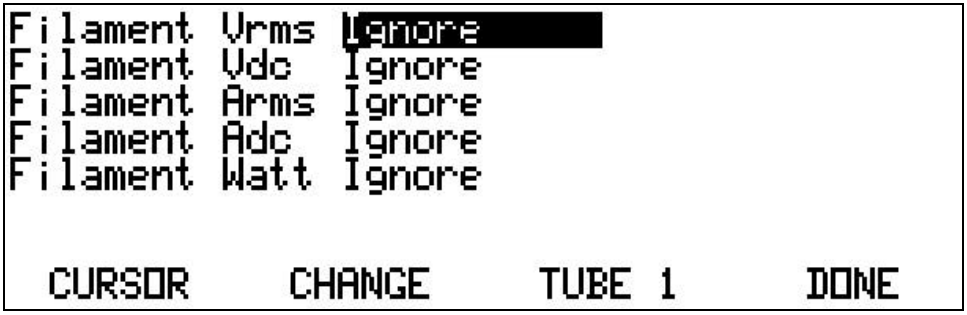
TUBE CURRENT & POWER

Limits are possible for the measured tube power, and current level (RMS and DC), crest factor, distortion, and modulation.



FILAMENT Limits

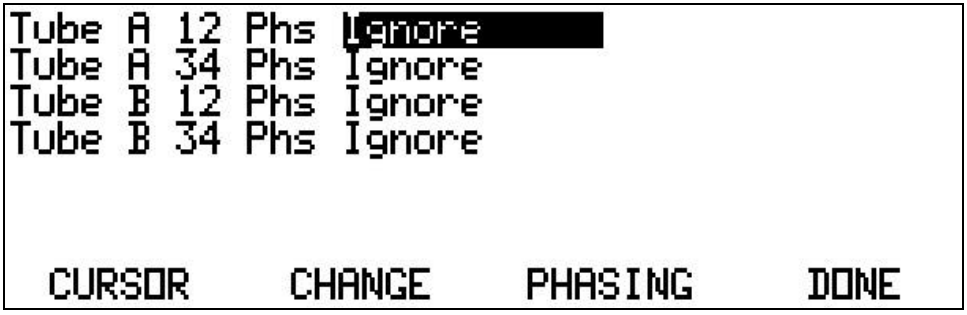
There are nine sets of limits, accessed by a **CHECK** test step as the *FILAMENT 1* through *9* groups. These measurements check against the actual measured values at the time of the **CHECK** test step.



Limits are possible for the measured filament voltage levels (RMS and DC), current levels (RMS and DC) and power. All configured filaments are measured against the same limits.

PHASING Limits

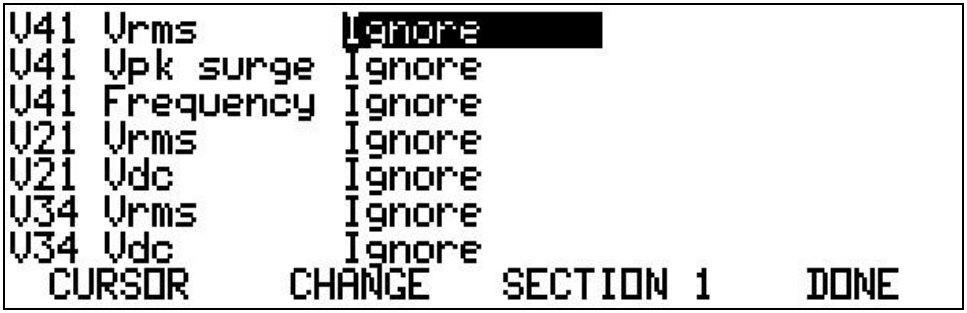
There is one set of limits, accessed by a **CHECK** test step as the *PHASING* group. These measurements check against the actual measured values at the time of the **CHECK** test step.



Limits are possible for the measured filament phasing respective to the primary tube voltage. Each filament is measured against separate limits.

SECTION Limits

There are nine sets of limits, accessed by a **CHECK** test step as the *SECTION 1* through *9* groups. These measurements check the measurements for the specified tube section against the actual measured values at the time of the **CHECK** test step. Note that the specified tube load section need not be configured as a ballast load.



Limits are possible for tube voltage (RMS and highest peak) and filament voltage levels (RMS and DC). Note that the measured highest tube peak voltages are cleared after being checked, accumulating a new highest peak until the next **CHECK** step for this *SECTION* or the next **INRUSH** test step.

Printing Test Sequence and Limits Details

Press the PRINT button while any of the Test Sequence step menus is being displayed, to obtain a report containing a listing of the complete test sequence and applicable limits.

A textual or PCL2 printer is required for this operation.

Viewing General Purpose Measurement Results

If you have selected a General Purpose mode in the **Configuration** screen, the display screens described below are available as selected by the NEXT key.

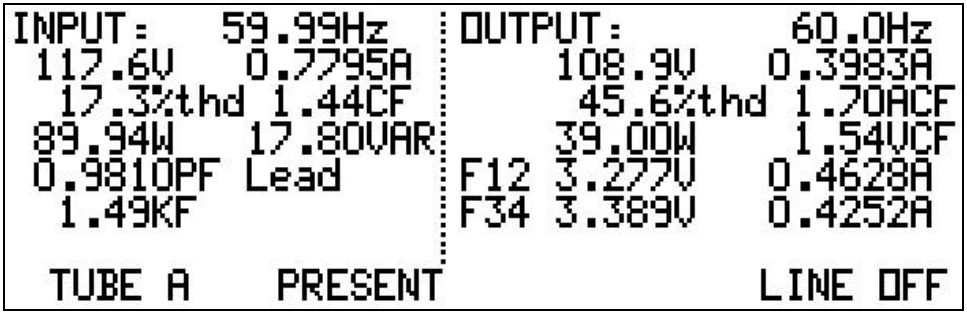
Displaying Numeric Measurement Results

The **Numeric Results** screens continuously update alpha/numeric measurement data for the configured ballasts and tubes.

- Press the F1 softkey to select a ballast by number that you have configured or select a tube by letter (BALLAST 1, 2, 3, 4 or TUBE A, B, C, or D).
- Press the F2 softkey to choose between the PRESENT screen and the STARTUP screens.
- Press the F3 softkey to choose between LEVELS and TIMING (when displaying the STARTUP information).
- Use the F4 softkey to select either LINE ON or LINE OFF.

PRESENT Screen

In the **Numeric** Results Present screen, the line-input measurements display in the left portion and the ballast output information is displayed in the right. If a configured ballast is selected, then the ballast output information is the average for all tubes. Any individual tube may also be selected.



The PRESENT screen continuously updates measurement results for the various tubes and configured ballasts. Note that data will display only for those ballasts that have been configured.

Line Input Measurements	Ballast Output Measurements
Line Frequency	Frequency—If configured as a high frequency output ballast.
Line Voltage (RMS)	Tube Voltage—The highest voltage between any two tube pins.
Line Current (RMS)	Tube Current—The RMS primary load current, (i.e., the sum of the current vectors in each pin of a 4-pin tube).
Line Current Distortion—The % of fundamental component.	Tube Voltage Distortion—The % of fundamental component.
Line Current Crest Factor	Tube Current Crest Factor—May include or exclude the affects of output modulation. Refer to ***Error! Reference source not found.***.
Line Power (real and imaginary)	Total Power
Line Power Factor, with a Lead/Lag indication	Ballast Efficiency—If ballast data has been selected by the F1 softkey.
Line Current K-factor	Filament voltages and currents for each filament—If a hyphen (-) displays with “F12” or “F34” this means measured filament voltage is out of phase with primary tube voltage for the selected tube (F1).

STARTUP Screens

There are two STARTUP screens in which you can review levels or timing measurements. This data is updated when the initial draw of line current from the ballast is detected.

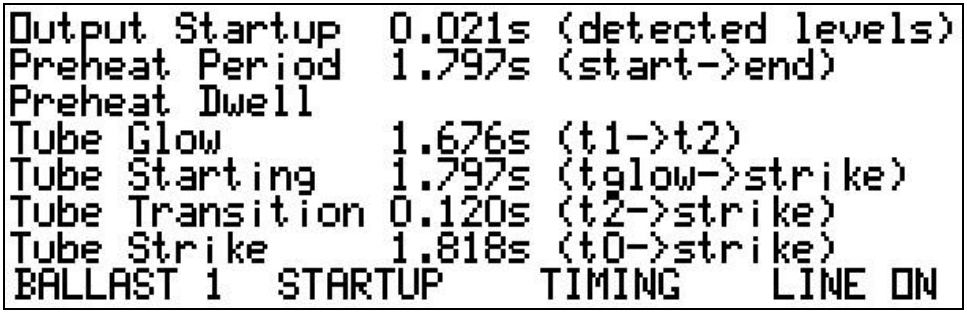
- Press the F1 softkey to select the ballast by number that you have configured or select the tube by letter (BALLAST 1, 2, 3, 4 or TUBE A, B, C, or D).
- Press the F2 softkey to choose between the PRESENT screen and the STARTUP screen.
- Press the F3 softkey to choose between LEVELS and TIMING.
- Use the F4 softkey to select either LINE ON or LINE OFF.

The information that displays on the Startup Levels screen covers the following measurement details—

Startup Levels Results
Highest Peak and RMS line input current during the configured inrush period for the selected ballast.
The average RMS voltage, current and power levels during the preheat period, configured as either the pre-strike period, or by level detection.
The average RMS voltage and current tube levels during the pre-transition period, following the detection of output signals from the ballast, and the frequency of these signals at the end of this period.
The highest peak and RMS tube voltage signals measured prior to achieving a sustained strike.
The highest peak and RMS tube currents measured after the start of the transition period.
The voltage crest factor at the end of the pre-transition period.

- Press the F1 softkey to select the ballast by number that you have configured or select the tube by letter (BALLAST 1, 2, 3, 4 or TUBE A, B, C, or D).
- Press the F2 softkey to choose between the PRESENT screen and the STARTUP screen.
- Press the F3 softkey to choose between LEVELS and TIMING.
- Use the F4 softkey to select either LINE ON or LINE OFF.

The information that displays on the Startup Timing screen covers the following measurement details—


Output Startup 0.021s (detected levels)
Preheat Period 1.797s (start->end)
Preheat Dwell
Tube Glow 1.676s (t1->t2)
Tube Starting 1.797s (tglow->strike)
Tube Transition 0.120s (t2->strike)
Tube Strike 1.818s (t0->strike)
BALLAST 1 STARTUP TIMING LINE ON

Startup Timing Results
The period of time after the detection of initial line current draw until the detection of ballast output signals.
The period of time over which preheat filament measurements have been made.
The time from the detection of sustained tube strike to the end of the preheat period.
The period of time between the initial detection of ballast output signals and the start of tube transition.
The period of time between the initial detection of tube current and sustained tube strike.
The period of tube transition.
The period of time between the detection of initial line current draw and sustained tube strike.

Printing Numeric Results

Press the PRINT button while either the PRESENT, STARTUP LEVELS, or STARTUP TIMING screens are displaying to obtain a Numeric Measurements report containing results regarding the configured ballast and tubes.

Displaying Harmonics Measurement Results

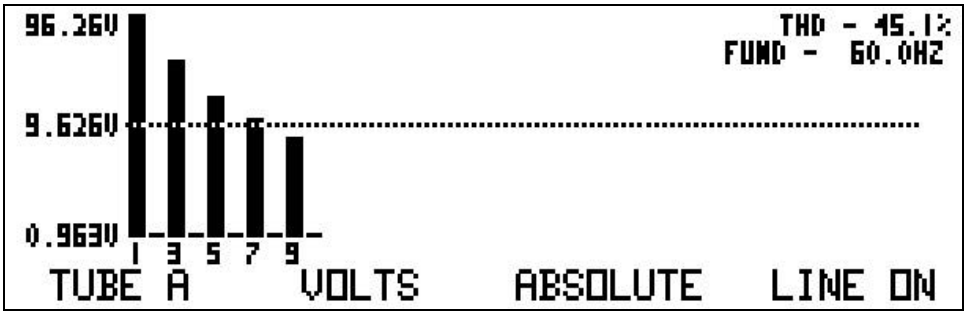
Press the NEXT button to display the **Harmonics Results** screens. These display barcharts showing the harmonics measurements of line voltage, line current, tube voltage or tube current. The results are specific to the ballast or tube drive you select.

Ballast Output Harmonic Results Screen

Refer to the upper right portion of the display for additional information concerning the selected ballast or tube.

- Press the F1 softkey to select whether the ballast (line) or tube measurements are displayed.
- Press the F2 softkey to select whether the voltage or current harmonics are displayed.

- Press the F3 softkey to select whether the display shows absolute units or a percent of the fundamental harmonic.



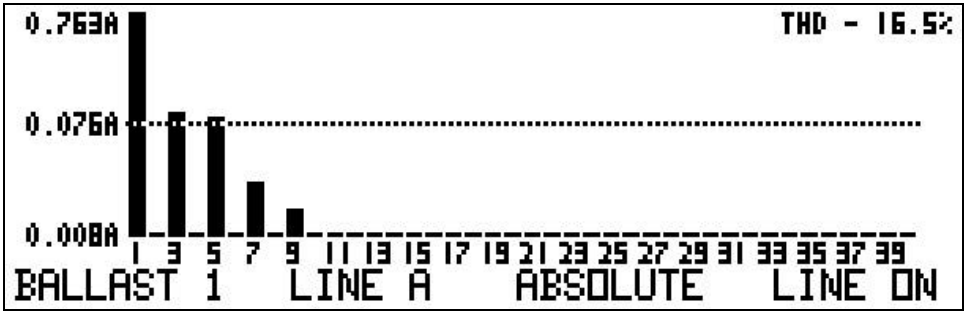
	Absolute units	% of fundamental
Voltage	V(ABS)	V(%)
Current	A(ABS)	A(%)

***Note*:** *The display shows the message NO HARMONICS AVAILABLE if the line frequency or voltage is insufficient for harmonics measurements.*

- Use the F4 softkey to select either LINE ON or LINE OFF.

Ballast Line Input Harmonics Results Screen

A vertical bar displays for each harmonic, logarithmically scaled over two decades, indicating the amplitude (or relative amplitude) of each harmonic. The scaling at the uppermost, mid, and lowermost points are numerically displayed in the left margin of the graph



Refer to the upper right portion of the display for additional information concerning the selected ballast or tube.

- Press the F1 softkey to select whether the line or tube measurements are displayed.
- Press the F2 softkey to select whether the line voltage or line current harmonics are displayed.

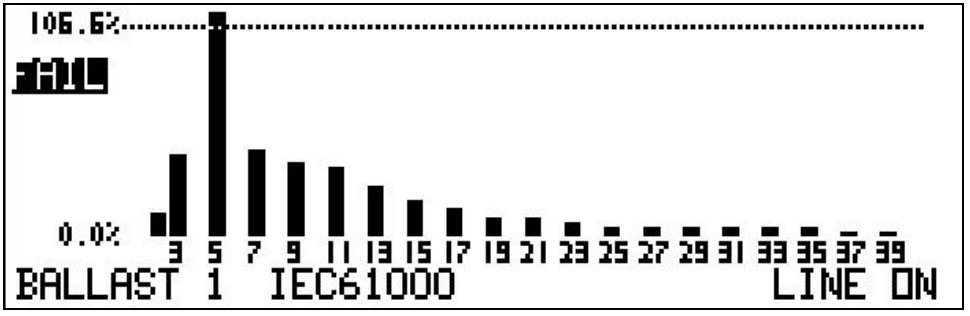
- Press the F3 softkey to select whether the display is relative to the fundamental harmonic or in absolute units.

	Absolute units	% of fundamental
Voltage	V(ABS)	V(%)
Current	A(ABS)	A(%)

IEC61000-3-2 Harmonics Results Screen

The IEC61000-3-2 Class C results can be observed if configured for these measurements.

- Press the F1 softkey to select whether the line or tube measurements are displayed.
- Press the F2 softkey to select the IEC61000-3-2 with linear scaling relative to the 100% of specification level for each harmonic.
- Use the F4 softkey to select either LINE ON or LINE OFF.

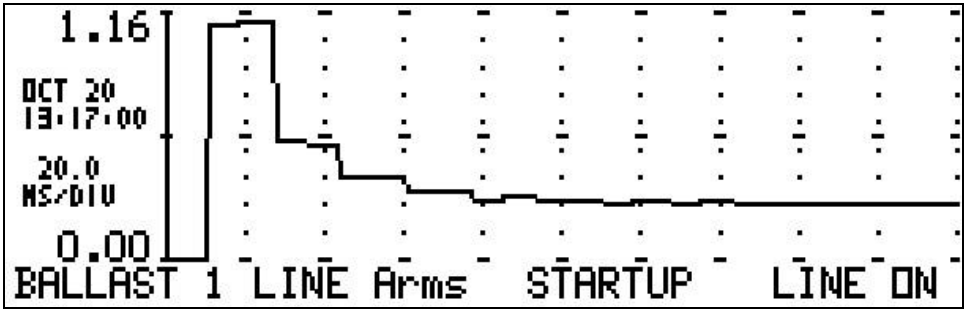


Printing Harmonics Results

Press the PRINT button to obtain a full printout of the barchart content presently being displayed. This requires a graphical (PCL2 compliant) printer.

Displaying Results Profiles

Press the NEXT button to display the graphical **Results Profile** screens. The History screen displays measurement profiles continuously in accordance with a configured timescale. The Startup Profile screen displays a time profile of the multiple measurements obtained during startup.



Note: *Historical and Startup data is cleared whenever their configurations are changed.*

History and Startup Profile Screens

These display screens show ongoing historical results or a startup profiles for configured ballasts, tubes, tube filaments and light monitor.

- Press the F1 softkey to select whether information regarding a ballast line input or an individual ballast tube output is to be displayed.
- Press the F2 softkey to select what kind of measurement to display. Your choices are—

For: BALLASTS 1, 2, 3, or 4	For: TUBES A, B, C, or D			For: LIGHT
LINE Vrms	TUBE Vrms	F12 Vrms	F34 Vrms	Watts
LINE Vpk	TUBE Vpk	F12 Vdc	F34 Vdc	%Eff
LINE Arms	TUBE Arms	F12 Arms	F34 Arms	
LINE Apk	TUBE Apk	F12 W	F34 W	
LINE Athd	TUBE KHz	F12 Ohms	F34 Ohms	
LINE W	TUBE W			
LINE PF	TUBE Ohms			
LINE Hz				
LINE %Eff				
LINE W Loss				

- Press the F3 softkey to select whether the Historical (scrolling) Profile or the Startup Profile is to be displayed.

Refer to the left column for date and time. These numbers represent the last update of the displayed data, division of time, and the time scaling of the display (horizontal). The time scaling is configurable for history and startup data, independently, in the *Measurement Timing* submenu as discussed on page 44.

- Use the F4 softkey to select either LINE ON or LINE OFF.

Printing Results Profile Plots

Press the PRINT button to obtain a printout of the graphical content presently being displayed. The Startup Data Plots include additional numerical data, depending on the configuration and data being displayed at time of printing.

Viewing Test Mode Measurement Results

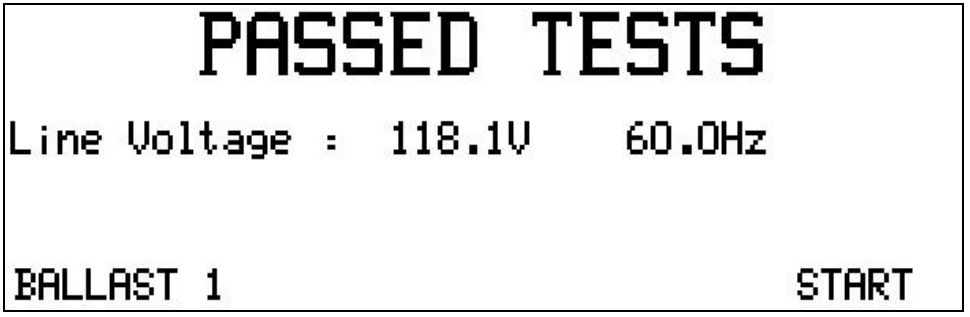
If you have selected a Test Sequence mode in the **Configuration** screen, the display screens described below are available as selected by the NEXT key.

Displaying a Summary of the Test Results

This screen shows –

- The status of the currently running, or the last completed, test sequence.
- The step presently being executed (if any).
- The presently measured line voltage and frequency.
- The last measured check failures (up to a maximum of three, the last are always displayed) from the current running, or last completed, test sequence.

While this screen is being displayed, the F4 key allows the user to START or ABORT a test sequence.

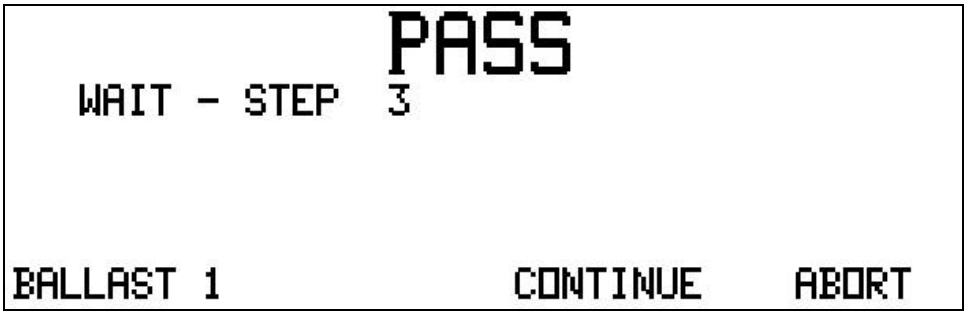


Partial Test Report Printout

Pressing the PRINT key while displaying this screen causes a printout of the test results for all CHECK steps. Only checks configured as to be checked or reported are included in this report, but the selection of whether to print (or not) is ignored.

Displaying an Interactive Wait Step Status

The 2574R will automatically display an “Interactive Wait” display screen while performing an INTERACTIVE WAIT test sequence step. This screen shows the test sequence step number being performed, the status of the check being performed while waiting (if any), and the actual measurements that are being checked (if any).

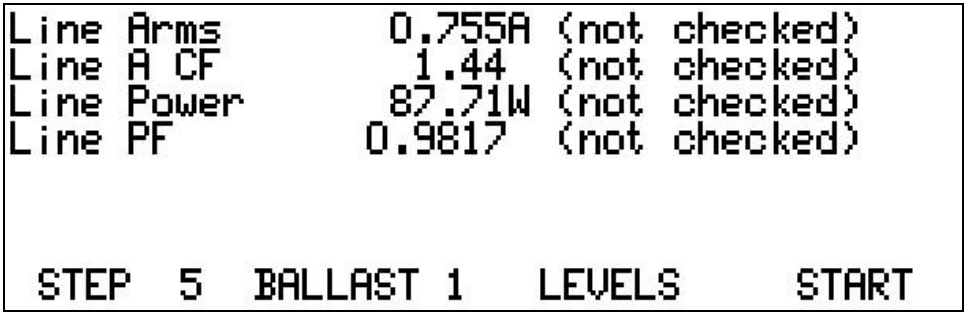


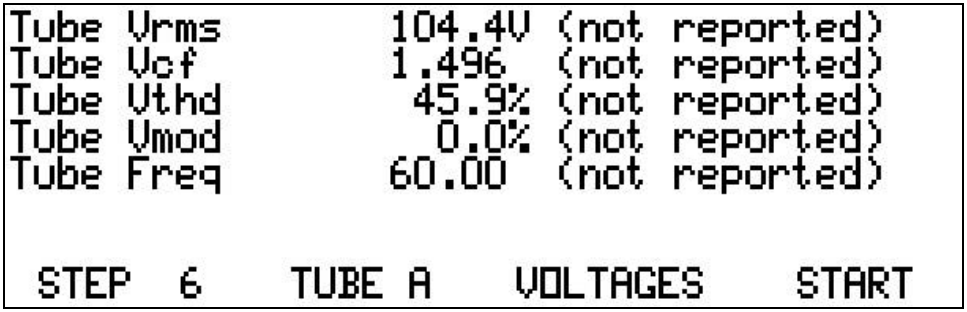
While this screen is being displayed, the F4 key allows the user to START or ABORT a test sequence, and the F3 key allows the user to continue from the INTERACTIVE WAIT step.

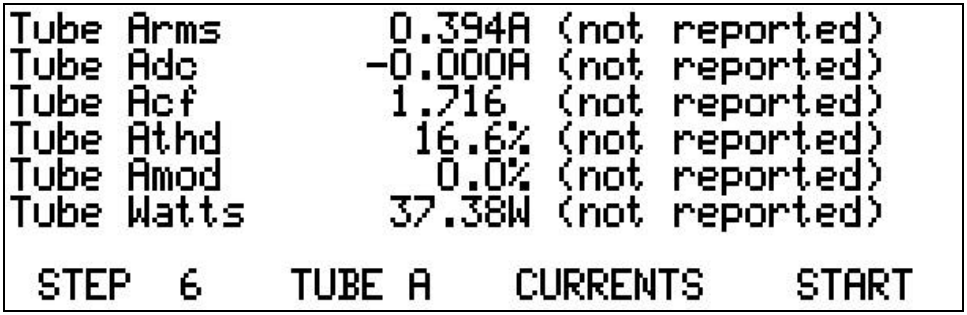
When the step is completed, the display automatically returns to that being displayed when the INTERACTIVE WAIT step was initiated.

Displaying Test Result Details

This screen shows all measurements collected during CHECK steps in the currently running, or last completed, test sequence.


Line Arms 0.755A (not checked)
Line A CF 1.44 (not checked)
Line Power 87.71W (not checked)
Line PF 0.9817 (not checked)
STEP 5 BALLAST 1 LEVELS START


Tube Vrms 104.4V (not reported)
Tube Vcf 1.496 (not reported)
Tube Vthd 45.9% (not reported)
Tube Vmod 0.0% (not reported)
Tube Freq 60.00 (not reported)
STEP 6 TUBE A VOLTAGES START


Tube Arms 0.394A (not reported)
Tube Adc -0.000A (not reported)
Tube Acf 1.716 (not reported)
Tube Athd 16.6% (not reported)
Tube Amod 0.0% (not reported)
Tube Watts 37.38W (not reported)
STEP 6 TUBE A CURRENTS START

The F1 key allows the user to select the CHECK step from which the data is to be displayed.

The F2 and F3 keys allows the user to select the ballast and/or ballast output for which the data is to be displayed, and the particular data to be displayed.

Full Test Report Printout

Pressing the PRINT key while displaying this screen causes a printout of the test results for all CHECK steps. All check results are included, whether configured to be checked, or reported, or ignored, are included in this report.

Displaying Harmonics Measurement Results

These display barcharts showing the harmonics measurements of line voltage, line current, tube voltage or tube current at the present time. These displays are the same as described for the General Purpose mode.

Displaying Results Profiles

The STARTUP and SEQUENCE Profile screen displays a time profile of measurements obtained during startup and during the entire sequence, respectively.

Printing a Startup or Sequence Profile

Pressing the PRINT key while displaying any of the startup or sequence profile screens, initiates a graphical printout (requires a PCL2 compliant printer) of the presently displayed profile plot.

Connecting Test Components to the Analyser

This chapter describes the various connectors on the 2574R rear panel and wiring test setups. For a complete listing of precautions refer to the chapter on *Installing and Maintaining the Analyser* found on page 18.

Rear Panel Connections

The rear panel contains all the connectors required for testing multiple types of ballasts, including connectors for the ballasts' power sources.

There are no restrictions against signals being present on these connections when the 2574R is not powered.

WARNING: *SHOCK HAZARD. NEVER CONNECT OR DISCONNECT ANY LIVE SIGNALS WHEN THE 2574R IS POWERED . THIS CAN BE LETHAL TO YOU AND MAY DAMAGE THE INSTRUMENT.*

WARNING: *IF THE POWER ANALYSER IS USED IN A MANNER NOT SPECIFIED BY XITRON TECHNOLOGIES INC., THE PROTECTION PROVIDED BY THE EQUIPMENT MAY BE IMPAIRED.*

Ballast Test Connections

Ballast test connections include Line Supply and Line Input, Tube (Load), and Ballast Output. This Ballast Test Connections section describes all the possible test connections. When making connections ensure that there are no voltages present on the connections.

Each test setup consists of two basic steps, which can be done in either order.

- Step one—make the physical wire connections to the *2574R*'s rear panel.
- Step two—select the appropriate mode of operation. Refer to the chapters on *Configuring the Analyser* and ***Error! Reference source not found.***.

All of the rear panel test connections use locking 0.156” spaced connectors. Additional connectors and pins may be ordered through Xitron Technologies or through Molex directly.

Component	Xitron Technologies part numbers	Molex part numbers
10 Pin Connector	CONF00100001	35156-1000
2 Pin Connector	CONF00020000	35156-0200
Pins for connectors	CONA00000022	50217-9001

Line Supply Connections

Connect the *2574R* rear panel's AC SOURCE connector to the power source for the ballast being tested. The Line connector goes to L and the Neutral connector goes to N. See *Figure 4*.

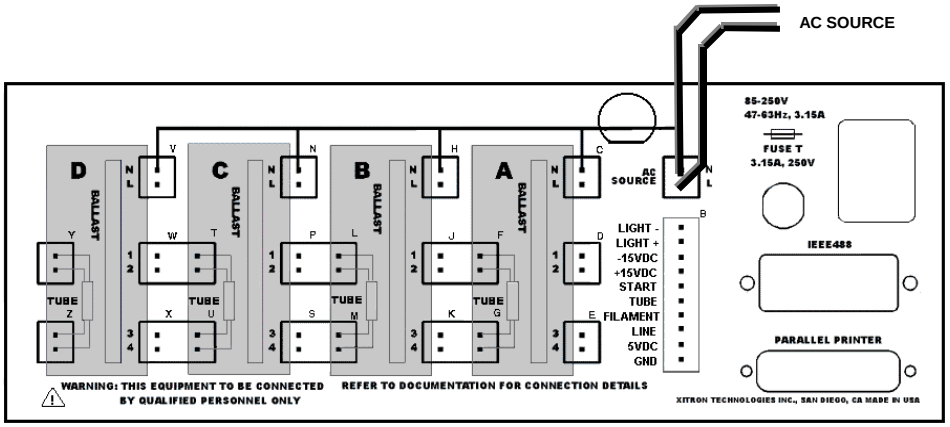


Figure 4. Line Supply Connections

Line Input Connections

There are many different methods of connecting the ballast line inputs to the analyser. Choose the method most suitable for your application using the guidelines given here for Single and Multiple Line Inputs.

USING A SINGLE LINE INPUT FOR EACH BALLAST

The single line connections are at the top of the rear panel sections labeled A through D. See *Figure 5*. Wire each ballast line input to a separate ballast line connection.

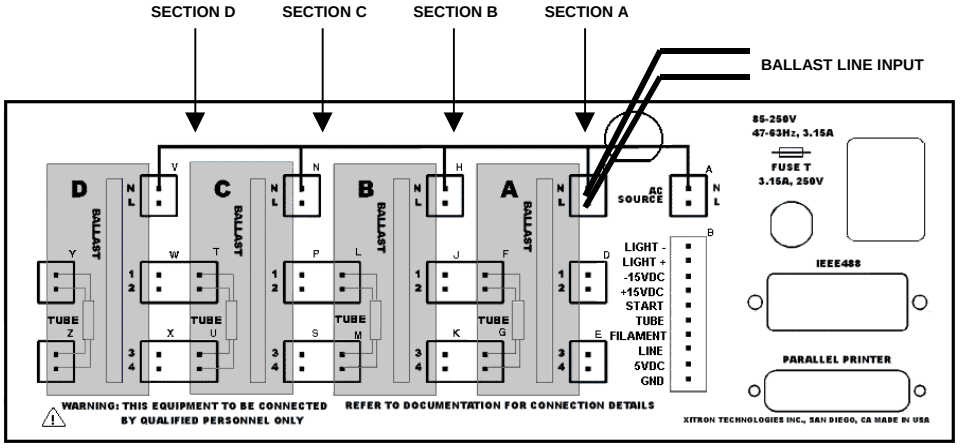


Figure 5. Single Line Input Ballast Connections

Use the Single Line Input configuration in any of the following situations—

- More than two ballasts are being tested.
  —or—
- The ballast(s) being tested have very low power consumption (less than 10W, with an inrush less than 5A).
  —or—
- The ballast(s) being tested have a power consumption of less than 1KW. It is not necessary to measure inrush currents in excess of 5A, and the actual inrush current is less than 50Apk.

For Single Line Input connections choose one of the following connection methods—

- Four (or fewer), one-tube ballasts: Use each of the sections A through D, in order and one connection for each ballast.
- Two, two-tube ballasts: Use sections A and C respectively.
- One ballast: Use section A.

USING MULTIPLE LINE INPUTS FOR EACH BALLAST

Wire each ballast line input to two (or more) ballast line connectors on the rear panel of the *2574R*. See *Figure 6.* For best results, apply at least 0.01Ω of resistance in each connection to ensure that the current is properly shared between connections.

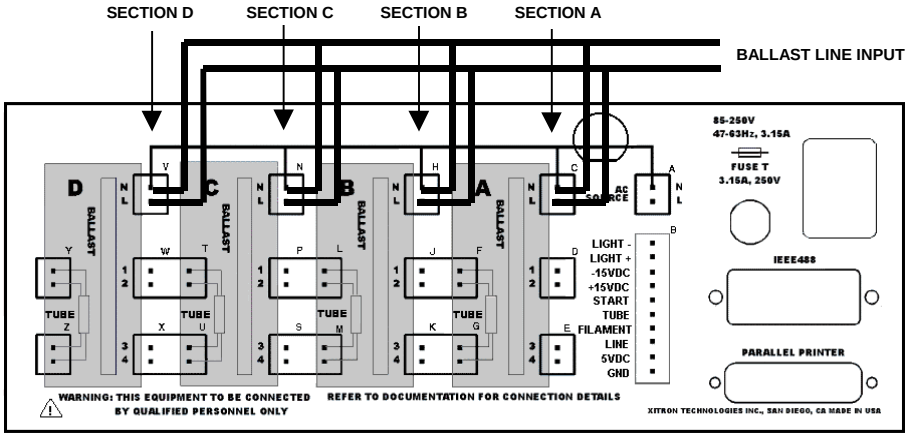


Figure 6. Multiple Line Input Ballast Connections (four are shown)

Use the Multiple Input wiring for any of the following situations—

- The ballast(s) being tested have a power consumption of more than 1KW.

  —or—

- The test requires you to measure inrush currents of over 5Apk.

For Multiple Input connections, choose one of the following—

- Two ballasts containing one- or two-tube: Use sections A and B for one ballast and sections C and D for the other ballast.
- One ballast: Use all four sections.

Load Connections

This section describes the line connections between the *2574R* and the tube(s) used for loads for the ballast(s) being tested. Any type of load may actually be used as a load for the ballast. The term “tube” does not imply that an actual tube must be used. When making connections ensure that there are no voltages present on the connections.

There are many different methods of connecting the tubes and ballast outputs with the *2574R*, however, the *Four-pin LOAD Connections* and *Two-pin LOAD Connections* cover the majority of applications and are recommended whenever possible.

With options QS or HID, only the two-pin tube option is available.

When testing ballasts having a load in excess of 1.5Apk (3Apk with option HC or HID, 6Apk with both options HID and HC) pin currents, multiple tube connections may be made in parallel as if there were actually more tubes. Contact Xitron Technologies for assistance if this is desired.

FOUR-PIN LOAD CONNECTIONS

Use the connection method shown in *Figure 7* and described below when testing four-pin ballasts, or multiple ballast types when some are of the four-pin variety.

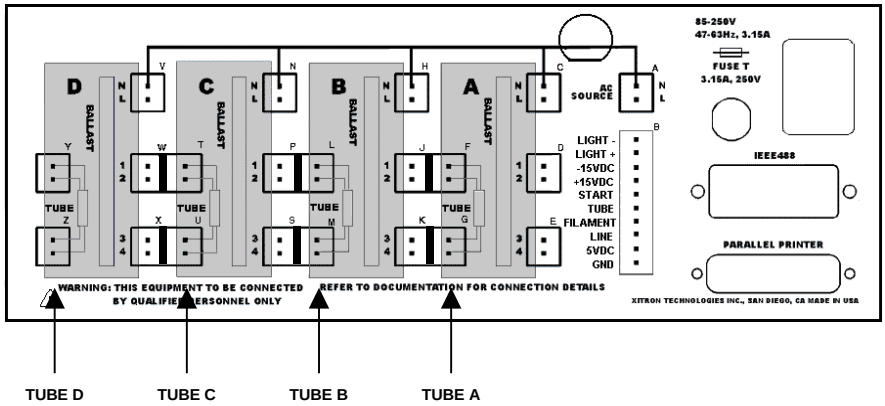


Figure 7. Four-pin Load Connections

If you always use these tube connections, then no further rewiring of the tubes will be required for all ballast connection types.

Also, note that the four-pin tube connection method allows for all combinations of ballast-tube wiring, i.e. parallel filaments, parallel tubes, series filaments, series tubes, and combinations of these. The only differences in wiring will be what is needed to accommodate the ballast itself, not the tube wiring.

♦ ***To connect for testing four-pin ballasts—***

1. Wire each load to the tube connectors in each section of the rear panel, as shown next to these connectors in Figure 7.
2. If only one tube is to be used, then use section A.
3. For two tubes, use sections A and B.
4. For three tubes, use sections A, B and C.
5. Ensure that all four wires of each tube are ONLY wired to one rear panel section.

CAUTION: *IF EXCESSIVE VOLTAGE IS PRESENT BETWEEN THESE PINS, THE INSTRUMENT MAY BE DAMAGED.*

Ensure that the filaments are connected between pins 1 and 2, and 3 and 4 of the 2574R. *Note that separate connectors are used for each filament.*

TWO-PIN LOAD CONNECTIONS

When only two-pin ballasts are being used, then connect the tubes as shown in *Figure 8* and described below.

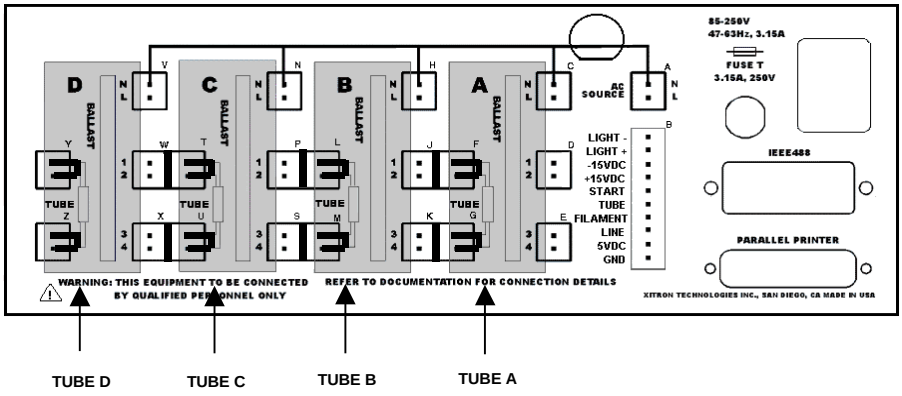


Figure 8. Two-pin Load Connections

♦ ***To connect for testing two-pin ballasts—***

1. Connect each load to all four tube connections in each section of the rear panel, similarly to the illustration shown in *Figure 8*. Each end of the load is connected to two connections on the rear panel (i.e., wire one end of the tube to pins 1 and 2 and the other end to pins 3 and 4).
2. If only one tube is to be used, then use section A.
3. For two tubes, use sections A and B.
4. For three tubes, use sections A, B and C.
5. Ensure that both wires of each tube are ONLY connected to one rear panel section.

Ballast Output Connections

This section describes the connections between the *2574R* and the output(s) of the ballast(s) being tested. When making connections ensure that there are no voltages present on the connections.

There are many different methods of connecting the tubes and ballast outputs with the *2574R*. Two methods that cover the majority of applications are the *Four-pin LOAD Connections* and *Two-pin LOAD Connections*. These two methods are recommended whenever possible.

Notes:

1. For the 2571QS, 2572QS, 2573QS and 2574QS model variations, only the two-pin tube option is available.
2. When testing ballasts having a load in excess of 2Apk pin currents, multiple tube connections may be made in parallel as if there were actually more tubes. Contact Xitron Technologies for assistance, if this is desired.

3. In general, the wiring from the ballasts' outputs is as if the *2574R* were the tube loads for the ballast.
4. When testing four-pin ballast, the actual phasing of pins 1 and 2, or pins 3 and 4, is not important.

FOUR-PIN LOAD, FOUR-PIN BALLAST OUTPUT

This connection method is not applicable to options QS or HID.

The loads should be connected as described in 4-PIN LOAD CONNECTIONS (above).

In the instruments' ***Ballast Type & Wiring*** *menu, the ballast type should be set to 4-pin.*

If a one-tube ballast is being tested or only one tube of a multi-tube ballast is being monitored, then use sections A through D respectively.

- Connect each ballast in sequence as shown in *Figure 9*. Use section A for ballast #1, and section B for ballast #2, etc.

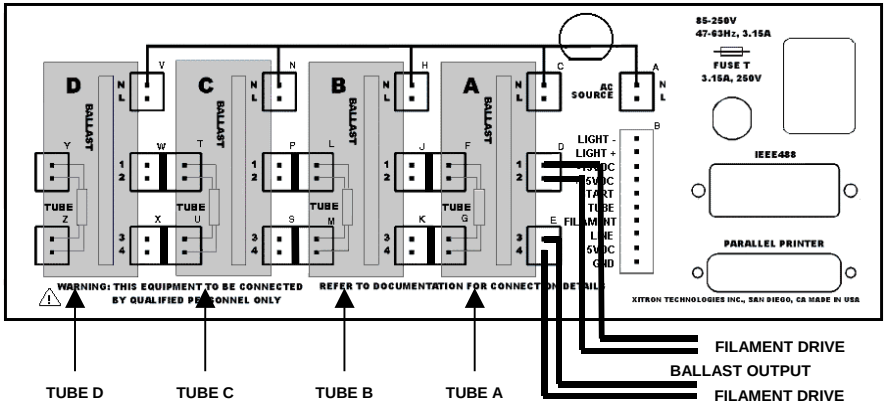


Figure 9. Example of Four-pin Load, Four-pin Ballast Output Connections

Note that if a two-tube ballast is being tested, or only two tubes of a multi-tube ballast are being monitored, then use sections A and B for ballast #1, and sections C and D for ballast #2.

If one (or more) of the ballast filament drives is intended to drive two (or more) tube filaments in parallel, then wire the ballast to the *2574R* as if the *2574R* is the tubes.

- Wire the filament output from the ballast to two (or more) sections of the *2574R* connections in parallel as shown in *Figure 10*.

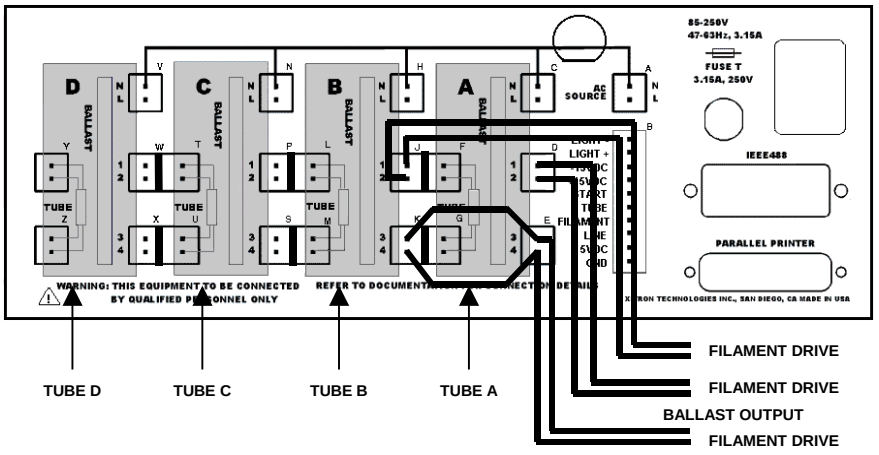


Figure 10. Example of Parallel Filament Outputs from a Ballast

If one (or more) of the ballast's filament drives is intended to drive two (or more) tube filaments in series, then wire the ballast to the 2574R as if the 2574R were the tubes.

- Wire the filament output from the ballast to two (or more) sections of the 2574R connections in parallel as shown in *Figure 11*.

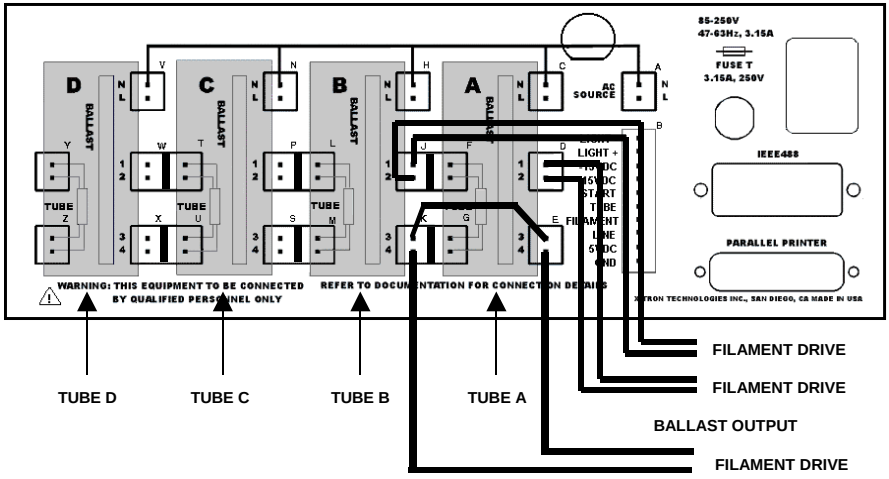


Figure 11. Example of Series Filament Outputs from a Ballast

FOUR-PIN LOAD, TWO-PIN BALLAST OUTPUT

This connection method is not applicable to option QS. This is the only connection method for option HID.

The loads should be connected as described in either 4-PIN LOAD CONNECTIONS or 2-PIN LOAD CONNECTIONS (above).

*In the instruments' **Ballast Type & Wiring** menu, the ballast type should be set to **2-pin** and the individual ballast wiring type set to **4-pin**.*

This offers the advantage of higher current measurement capability over the 2-PIN LOAD, 2-PIN BALLAST method described later.

Note: *Ensure that each connection from the ballast connects to both pins 1 and 2, or pins 3 and 4 of the 2574R.*

If a one-tube ballast is being tested, or only one tube of a multi-tube ballast is being monitored, then use sections A through D respectively.

- Connect each ballast in sequence as shown in *Figure 12*. Use section A for ballast #1, use section B for ballast #2, etc.

Note that if a two-tube ballast is being tested, or only two tubes of a multi-tube ballast are being monitored, then use sections A and B for ballast #1, and sections C and D for ballast #2.

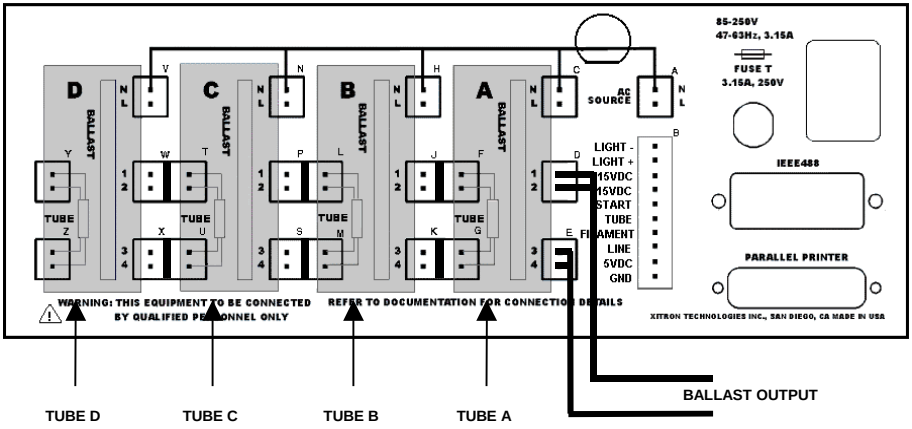


Figure 12. Four-pin Load, Two-pin Ballast Output Connections

If one (or more) of the ballast's output wires is intended to drive two (or more) tubes in parallel then wire the ballast to the 2574R as if the 2574R were the tubes.

- Wire the output from the ballast to two (or more) sections of the 2574R connections in parallel as shown in *Figure 13* .

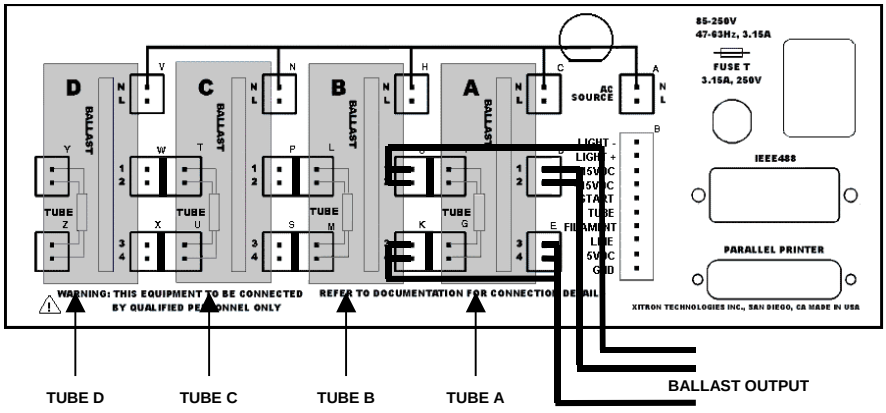


Figure 13. Example of Parallel Outputs from a Ballast

TWO-PIN LOAD, TWO-PIN BALLAST OUTPUT

This connection method applicable to all options. This is the only connection method for option QS.

The loads should be connected as described in 2-PIN LOAD CONNECTIONS (above).

*In the instruments' **Ballast Type & Wiring** menu, the ballast type should be set to **2-pin** and the individual ballast wiring type set to **2-pin**.*

Other than for option QS, the use of the 4-PIN LOAD, 2-PIN BALLAST method is recommended.

For two-pin tubes and ballasts, wire each ballast output to each section's ballast connections as detailed in the next two figures.

Note: *Ensure that each connection from the ballast connects to only pin 2, or pin 4 of the 2574R.*

If one (or more) of the ballast output wires is intended to drive two (or more) tubes in parallel, then wire the ballast to the 2574R as if the 2574R were the tubes.

- Wire the output from the ballast to two (or more) sections of the 2574R connections in parallel as shown in *Figure 14*.

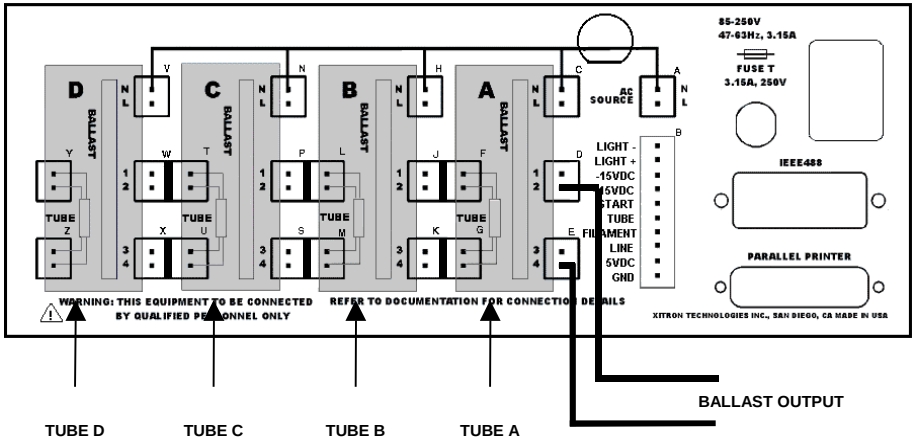


Figure 14. Two-pin Load, Two-pin Ballast Output Connections

If a one-tube ballast is being tested, or only one tube of a multi-tube ballast is being monitored, then use sections A through D respectively.

- Connect each ballast in sequence. Use section A for ballast #1, use section B for ballast #2, etc. as shown in *Figure 15*.

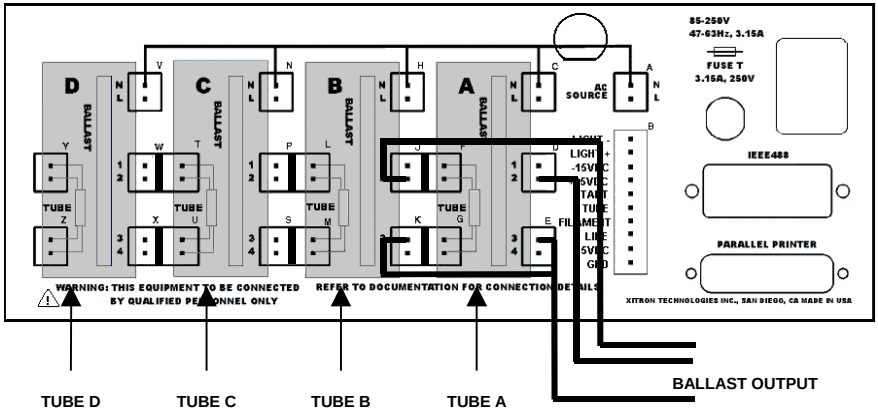


Figure 15. Example of Parallel Outputs from a Ballast

Note that if a two-tube ballast is being tested, or only two tubes of a multi-tube ballast are being monitored, then use sections A and B for ballast #1, and sections C and D for ballast #2.

Light-Power Monitor Connections

The following section describes the connections between the 2574R and the output(s) of a light-power monitor device. When making connections ensure that there are no voltages present on the connections. Refer to *Figure 16*.

- Connect the DC Voltage output of the Light-Power Monitor to the rear panel's 10-pin connector at pins labeled "LIGHT -" and "LIGHT +". Observe correct polarity.

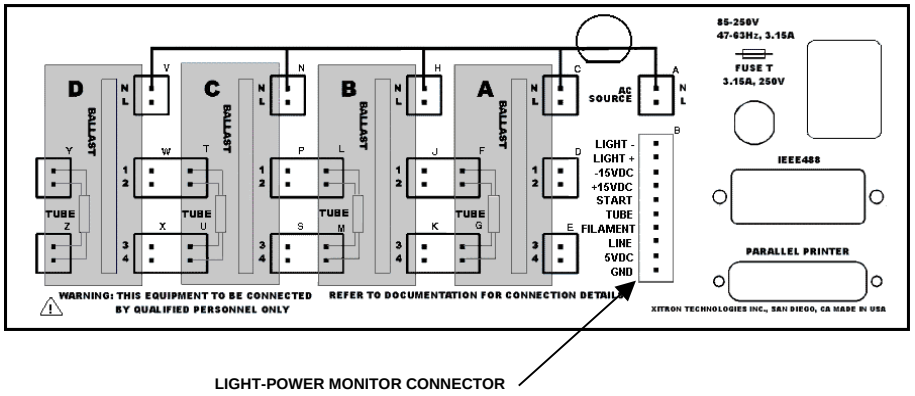


Figure 16. Light Monitor Connector

- If required, connect the respective inputs of the Light-Power Monitor to pins labeled "+15V, -15V, +5V," and "Ground".

Interface Connections

General

There are many potential sources of interference when testing ballasts, particularly ballasts of the HID type. This interference can severely affect interface cabling of poor quality or with insufficient shielding. Particularly in a high volume production environment, it is highly recommended that all cable lengths be kept to a minimum and that the highest quality, fully shielded cables be used.

IEEE488 Interface

A standard IEEE488 interface cable (the use of a high quality, fully shielded cable is highly recommended) should be attached to the IEEE488 connector on the rear panel of the 2574R.

RJ45 Style 1500 Chassis Interface

If configured to control one or more 1500 chassis using this interface (using the 1510 controller interface in the 1500 chassis) then these should be connected to the RJ45 style LOAD connectors on the 2574R rear panel.

Other than the order in which redundant load and switches are selected, there is no particular importance to which connector(s) are used. Redundant loads and switches are selected first from the lowest numbered load connector, and the lowest lettered “slot” in that chassis.

When connecting or disconnecting a 1500 chassis, the 2574R may take up to 5 seconds to recognize the change.

A straight through 8-wire RJ45 cable should be used. For cable routing longer than 10 feet, the use of shielded cabling is recommended.

Parallel Printer Connector

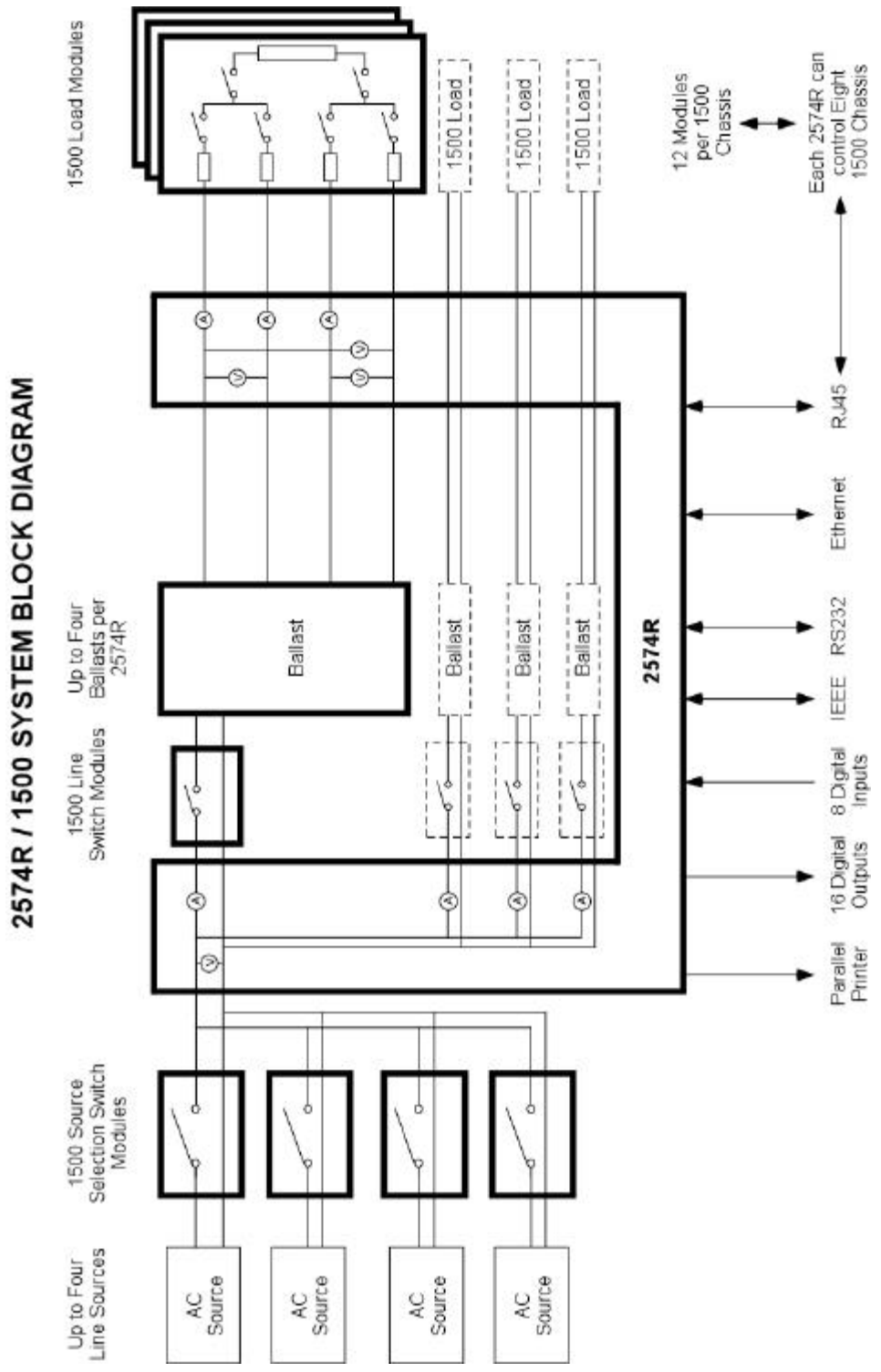
The 25-pin D-type connector on the rear panel of the 2574R is wired to enable the use of a standard PC compatible computer interface cable to a printer.

Digital I/O Interface Connector

This is a 25-pin D-type connector. The pinout is shown earlier in this manual.

Ethernet Connector

This is a standard 10BaseT connector.


2574R / 1500 SYSTEM BLOCK DIAGRAM
Up to Four Line Sources
AC Source
AC Source
AC Source
AC Source
1500 Source Selection Switch Modules
1500 Line Switch Modules
Up to Four Ballasts per 2574R
Ballast
Ballast
Ballast
Ballast
1500 Load Modules
1500 Load
1500 Load
1500 Load
2574R
Parallel Printer
16 Digital Outputs
8 Digital Inputs
IEEE
RS232
Ethernet
RJ45
12 Modules per 1500 Chassis
Each 2574R can control Eight 1500 Chassis

Using a 1500 Chassis with the 2574R

The 1500 chassis provides a very flexible systems capability for product testing of ballasts. The 2574R can control one (or more) 1500 chassis by means of the proprietary RJ45 style interface, the IEEE488 interface or the RS232 interface. The method of configuration of both the 1500 loads and switches and the 2574R is independent of the interface method.

The 1500 chassis can contain several different types of modules –

Redundancy

Multiple modules may be fitted, within the same system, which are configured in the identical manner. In this case, the 2574R will automatically select the required switch found in the lowest numbered chassis, and the lowest lettered slot within that chassis. Line switches or loads can be flagged as being faulty (either by the user or by test sequence activity) and will be automatically skipped.

The load switches and line switches have been specially designed to reduce the possibility that a failed module will affect to operation of parallel wired, redundant, modules.

Adding and Removing Modules

Modules may be inserted or removed from 1500 chassis whenever a test sequence is not being performed, or chassis may be added or removed from the 2574R. The 2574R may take up to 5 seconds to recognize the removal or addition of a chassis. When inserting a new module into a chassis the user should use the REFRESH key on the 1500 chassis to cause the 1500 and 2574R to recognize the newly inserted module.

Unused Modules

Unused load modules may be left disconnected, however unused line switch modules should have their line input terminals shorted together to prevent interference causing their phase sensitive measurement from being incorrectly activated.

Line Switch Module (1581)

These modules allow the user to either switch the output of a line source or switch the line power input to a ballast. The turn-on phase of these switches can be programmed in the 2574R, with the 1581 controlling the phase to within 1 degree for line frequencies in the range 30Hz to 500Hz.

Line switch modules have internal arrestor protection against voltages in excess of 1500Vpk. The user may need to connect “snubber” capacitors across particularly inductive line source outputs, or ballast line inputs to ensure than there is minimal interference from line switching transients.

Line Source Selection Switches

Line switches can be configured in the 1500 to provide a line source selection multiplexer.

CONFIGURING LINE SOURCE SELECTION SWITCHES

This is accomplished by using the MODULE (F1) key on the 1500 and selecting that the desired module be set for a ***Source*** type switch. The module is then configured for the letter (***A***, ***B***, ***C***, or ***D***) corresponding to the source that the switch is controlling. This letter corresponds to the source selection letter used in the 2574R ***Ballast Line & Load*** menu and in ***each Test Sequence Step*** menu.

If any switch is configured as a line source selection switch, then the 2574R will raise an error and abort a test sequence if no source selection switch can be found for the configured line source letter selection required. If no line switches are configured in this manner then the 2574R effectively ignores the line source selection letter (it is also available from the digital I/O interface).

WIRING LINE SOURCE SELECTION SWITCHES

Each line source selection switch input should be connected to the output of the corresponding line source. The user should take careful note of the L and N designations on the 1581 module as only the L side is switched. Also ensure that the output of the line source is connected to the switch input, otherwise the phase capability of the switch will be lost.

All line source selection switch outputs should be connected together, and connected to the Line Source input of the 2574R. Ensure that the L and N designations are maintained through this connection.

PROTECTING LINE SOURCE SWITCHES

Most line sources have internal protection that is well below the maximum limit of the 1581 line switch (250A for 1 line cycle) and thus no extra protection for multiplex connected line source selection switches is needed. In some circumstances, it may be required to place an in-line fuse of high enough rating for normal operation to ensure that a line switch failure will not cause excessive line currents.

Ballast Line Switches

Line switches can be configured in the 1500 to provide a line on/off switch for individual ballasts.

CONFIGURING BALLAST LINE SWITCHES

This is accomplished by using the MODULE (F1) key on the 1500 and selecting that the desired module be set for a ***Switch*** type switch. The module is then configured for the number (***1***, ***2***, ***3***, or ***4***) corresponding to the ballast which the switch is controlling. This number corresponds to the ballast number used in the 2574R ***Ballast Type & Wiring*** menu.

If any switch is configured as a ballast line switch, then the 2574R will raise an error and abort a test sequence if no ballast line switch can be found for the ballast being tested.

Normally the 2574R uses the desired line source switch to select the source, and then turns on/off the ballast using its configured line switch. In the “special” case where no line switches are configured, but line source selection switches are configured, then the 2574R will control the power to the ballasts by using the line source switches. In this case, the line power to all ballasts will be simultaneously applied or removed.

WIRING BALLAST LINE SWITCHES

Each ballast line switch input should be connected to the corresponding (as set in the Ballast Type & Wiring menu of the 2574R) line connector of the 2574R rear panel. The user should take careful note of the L and N designations on the 1581 module as only the L side is switched.

Each switch output should be connected to the line input terminals of the ballast being tested.

Auto-Load Modules (1520, 1530 and 1540 Families)

Auto-Load modules provide resistive loading for each ballast output. These are available in 100W (1520), 200W (1530) and 300W (1540) variants, and in two-pin (15x2) and four-pin (15x4) variants. The 2574R draws no distinction between these modules.

These loads can be programmed by the 2574R as OFF, FIL or ON and are intended to be used as the AUTO load type in the 2574R menus.

Each module is built with a specific tube resistive value and (if a four-pin type) filament resistive value. Each different combination of values and power levels are factory programmed with a different 4 digit ID number. The user cannot change this number, and the specific load required in a test sequence or in general purpose mode may be specified by means of this 4-digit code. Factory programmed codes are in the range 2000 and above.

CONFIGURING LOAD MODULES

The user must configure the 1500 with details regarding to which load section of the 2574R it is connected. This is accomplished by selecting the MODULE key on the 2574R to select the desired modules, and then setting the section letter (A, B, C or D) to correspond to the letter of the section of the 2574R to which it is wired.

USING ALTERNATE CODES

The user may specify an Alternate ID code for any specific load module. This indicates top the controlling 2574R that this module is to be used for this code if no module is factory programmed (primary code) with this code. The user may program the module to have an alternate code of any value by using the MODULE key on the 1500 front panel.

USING PARALLEL CODES

In some situations, the user may wish a ballast output to be simultaneously loaded by more than one load module. Normally, the 2574R may only select that one load module is engaged for each ballast output.

Any load module may have a Parallel Code programmed by the user (using the MODULE key on the 1500). This identifies that this load should be engaged by the 2574R whenever the specified code is configured in the 2574R test sequence or Ballast Line & Load menu. Any number of modules may be so configured.

WIRING LOAD MODULES

The pair of two-pin connectors on the load module should be wired to the corresponding pair of two-pin connectors for the load in the configured section of the 2574R rear panel. There is no specific orientation of the pairs of pins.

When switching in the tube load following strike detection of the ballast, some ballasts may output a large current surge into the suddenly switched load. In this case this large current surge (typically several amps for several tens of microseconds) will shorten the life of the switch, may cause interference problems, and is not truly representative of a “real” load. In these situations passing the wiring to each end of the load module through a ferrite bead is recommended (one or two turns is usually sufficient to correspond to the tube inductance of a typical tube load).

LOAD MODULE TEMPERATURE

Each auto-load module has the temperature of the air surrounding the resistive loads measured. The range (lowest and highest within the chassis) measured is displayed on the 1500 front panel. The 1500 automatically temperature regulates the loads to maintain the required amount of cooling air movement without unnecessary fan noise.

CAUTION : THE DISPLAYED TEMPERATURE IS NOT THE TEMPERATURE OF THE LOAD RESISTORS. USE EXTREME CARE WHEN EXTRACTING A LOAD MODULE WHICH HAS BEEN RECENTLY USED. THE OPERATIONAL TEMPERATURE OF THE RESITIVIE LOADS MAY EXCEED 100C.

Tube Load Switch Modules (1520)

The 12520 module provides a basic four-pole switch, enabling the user to switch tube loads, or any other type of load desired.

These load modules are similar to the auto-load modules above, but do not have a factory programmed primary ID code, but have a user programmed primary ID code instead. The alternate and parallel code capabilities are the same as for the auto-loads.

These loads can be programmed by the 2574R as ON or OFF only and are intended to be used for switching actual tube loads (using the TUBE load type in the 2574R menus).

Appendix A-Interface Specifications

Note: *Specifications are subject to change without notice.*

Front Panel

Liquid Crystal Display—

240 x 64 High-Speed Graphics LCD with CCD Backlight (5" x 1.35" viewing area)

Keyboard—Two fixed purpose buttons + four softkeys

Parallel Printer

Printer Interface—Parallel IEEE1284

Format—Unformatted text or PCL2 (user selectable)

Data Rate—Up to 24000 characters per second (limited by printer)

Compatible Printers—

Required for textual printouts: any 80 character wide (or more) by 66 character long (or more) ASCII parallel text printer

Required for graphical printouts: PCL: Hewlett-Packard DeskJet family, Hewlett-Packard LaserJet family, other PCL level two (or higher) compatible parallel printer with 75dpi or greater raster graphics print resolution

IEEE488

Interface—

IEEE488.1 (Certain commands conform to IEEE488.2)

Addressing—

Single address, user selectable via front panel between 0 and 29 inclusive

Capabilities—

SH1 AH1 T6 L4 SR1 RL1 PP0 DC1 DT1 C1 E2 (350ns min. T1)

Max. Talk Data Rate—
>300,000 bytes per second

Max. Listen Data Rate—
>100,000 bytes per second

Command Set—
ASCII textual command sequences.

Results—
Any results may be obtained at any time from the interface as ASCII textual numeric data. Additionally, status and state interrogatives are provided for "on the fly" determination of product status.

Appendix B - Physical Specifications

Note: *Specifications subject to change without notice.*

Temperature & Humidity

Operating:	0°C to 40°C, <85% RH @ 40°C non-condensing
Storage:	-30°C to 65°C, <95% RH @ 40°C non-condensing

Size & Weight

Size:	(HxWxD) 4½" x 11½" x 10½"
Weight:	8½lbs (3.9Kg)

Power Input

Voltage:	80-265Vrms (auto-selecting)
Frequency:	50/60/400Hz @ 60VA maximum

Appendix C - Signal Specifications

Note: *Specifications subject to change without notice.*

Ballast Inputs

Voltage

Withstand:	1.5KVpk, 600Vrms, continuous 3KVpk, 1.5KVrms for < 1 second
Measurement:	25 - 1500Vpk, 25 - 450Vrms
Burden:	1Mohm, Line or Neutral to Ground

Current

Withstand:	7Arms, 100Apk continuous (per section) 25Arms, 200Apk for < 100ms (per section) 75Arms, 350Apk for <100ms (total)
Measurement:	5Apk, 10mA -3Arms (per section) 18Apk, 40mA - 11Arms (all sections; total)
Burden:	< 0.015ohm

Power

Measurement:	0 - 3500W (per ballast)

Frequency

Measurement:	40-600Hz
Bandwidth:	User selectable 5KHz or 200KHz –3dB

Ballast Outputs

Voltage

Withstand:	3KVpk, 500Vrms continuous (any pin to ground) 3KVpk, 1.5KVrms for < 1 second (any pin to ground) 400Vpk, 50Vrms continuous (across filament) 1KVpk, 200Vrms for < 100ms (across filament)
Measurement:	25 - 3KVpk, 25 - 1500Vrms (across tube) decreasing linearly to 150Vrms at 2MHz (across tube) 1 – 50Vpk, 1 – 30Vrms (across filament)
Burden:	< 20pF (each pin 2, 3 and 4 to ground) < 5pF (pin 1 to ground) < 2pF (between pins) 500Kohm (between pins 1 & 4) 10Kohm (between pins 1 & 2, and 3 & 4)

Current

Withstand:	20Apk, 3Arms continuous (each pin) 50Apk, 10Arms for < 1 second (each pin)
Measurement:	1.5Apk, 10mA - 1Arms (each pin)
Burden:	0.1ohm (each pin)

Power

Measurement:	0 - 2000W (per tube)

Frequency

Measurement:	20 – 2KHz, or 5KHz - 2MHz
Bandwidth:	Typically 20MHz –3dB

Option HID

Change Ballast Output specifications to :

Voltage

Withstand:	3KVpk, 1KVrms continuous (each end of tube to ground) 4.5KVpk, 2KVrms for < 2 minutes (each end of tube to ground)
Measurement:	50 – 4.5KVpk, 50 – 3KVrms
Burden:	< 15pF (each end of tube to ground) 1Mohm (across tube)

Current

Withstand: 25Apk, 6Arms continuous
50Apk, 15Arms for < 1 second

Measurement: 3Apk, 20mA - 2Arms

Burden: 0.05ohm

Power

Measurement: 0 - 8000W (per tube)

Frequency

Measurement: 20 – 2KHz, or 5KHz – 100KHz

Bandwidth: Typically 2MHz –3dB

Option HI

Change ballast output voltage withstand specification from 3KVpk for < 1 second to 4.5KVpk for < 1 second.

Option HC

Change ballast output current and power specifications to :

Current

Withstand: 20Apk, 4.5Arms continuous (each pin)
50Apk, 15Arms for < 1 second (each pin)

Measurement: 3Apk, 20mA - 2Arms (each pin)

Burden: 0.05ohm (each pin)

Power

Measurement: 0 - 4000W (per tube)

When used with option HID changes ballast output current and power specifications to :

Current

Withstand: 30Apk, 9Arms continuous
60Apk, 20Arms for < 1 second

Measurement: 6Apk, 40mA - 4Arms

Burden: 0.025ohm

Power

Measurement: 0 - 16000W (per tube)

Option M

Change ballast output voltage measurement specification to :

Measurement: 30 - 1500Vpk, 30 - 1000Vrms (across tube)
decreasing linearly to 150Vrms at 2MHz (across tube)
1 – 50Vpk, 1 – 30Vrms (across filament)

Option F

Change ballast output frequency specification to :

Measurement: 20 – 2KHz, or 5KHz – 100KHz

Bandwidth: Typically 2MHz –3dB

Appendix D - Measurement Specifications

Unless otherwise indicated, all performance specifications are valid throughout the specified operating temperature range, for a period of one year, following a 15-minute warm-up period. All accuracy specifications include all accuracy-affecting error sources, including—noise, common mode rejection, inter-tube coupling, etc.

Note: *Specifications subject to change without notice.*

Methods

Technique—

Up to 5 real-time DSPs (each 100MIPS, triple width pipeline, 24-bit, L1 burst cached). All results continuously updated in all modes of operation.

Analog-Digital Conversion—

12-bit at 100KSPS to 1.5MSPS (quasi-randomly dithered), simultaneous sampling of all inputs within the set of line signals and within each tube.

Line Amplitude Measurements—

Automatically synchronized to ½ cycle of fundamental, with continuous coverage of input signal. Results updated every ½ cycle of line.

High Frequency Tube Amplitude Measurements—

Automatically synchronized to 1 cycle of fundamental, with continuous coverage of input signal. Results updated every 512µs nominally.

Power Measurements—

Averaged, digitally multiplied voltage and current samples.

Peak Measurements—

Sample based, continuous coverage peak hold.

Line Harmonics Measurements—

2K or 8K point DFT automatically synchronized to 2 cycles (16 cycles for IEC61000-3-2 Class C testing) of fundamental (within 0.01%) with continuous coverage of input signal. Sampling is anti-alias filtered by >50dB by combination of passive and digital filtering.

Tube Harmonics Measurements—

64 to 256 point DFT automatically synchronized to fundamental.

Frequency Measurements—
Continuously tracking, variable width, adaptive bandpass filter-based period measurement of voltage signals.

Software Upgrade—
Software field upgradable via IEEE488 interface, latest released revisions of software available via Internet using Xitron Technologies' FTP site or e-mail.

Manufacturing & Design—ISO9001 and US FDA certified.

Ballast Input Measurement Accuracy

Voltage

RMS MEASUREMENTS

50/60Hz: 0.1% reading + 0.1V

400Hz: 0.15% reading + 0.1V

Add 0.2V when DC is included
Add 0.1% reading for voltages > 300Vrms

Example—

For a reading of 220V at 50Hz, the accuracy specification is—

(0.1% x 220V) + 0.1V = 0.32V

HARMONIC MEASUREMENTS

Harmonics: 40

Accuracy: RMS measurement accuracy + 0.05% reading x harmonic

PEAK MEASUREMENTS

RMS measurement accuracy + 1V

Current

RMS MEASUREMENTS

50/60Hz: 0.1% reading + 0.5mA*

400Hz: 0.18% reading + 0.5mA*

Add 5mA* when DC is included (requires use of *DC Zero* calibration)

** Multiply the mA portion by the number of sections used for ballast line input.*

Examples—

For a reading of 100mA at 50Hz, one ballast line input being used, the accuracy specification is—

(0.1% x 100mA) + 0.5mA = 0.6mA

For a reading of 100mA at 50Hz, four ballast line inputs being used, the accuracy specification is—

(0.1% x 100mA) + 4 x 0.5mA = 2.1mA

HARMONIC MEASUREMENTS

Harmonics: 40

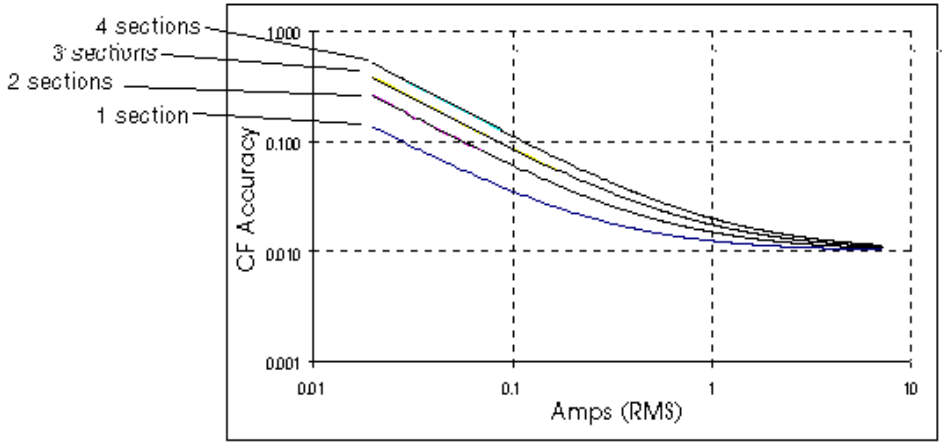
Accuracy: RMS measurement accuracy + 0.05% reading x harmonic

PEAK MEASUREMENTS

RMS measurement accuracy + 5mA*

** Multiply the mA portion by the number of sections used for ballast line input.*

CREST FACTOR MEASUREMENTS



Power

	PF > 0.95	0.8 < PF < 0.95	PF < 0.8
50Hz	0.2%	0.225% / PF	0.275% / PF
60Hz	0.2%	0.23% / PF	0.29% / PF
400Hz	0.55%	0.75% / PF	1.15% / PF

Add 0.02W* when DC is not included
Add 0.05W* when DC is included (requires use of DC Zero calibration)
Add 0.1% reading for voltages > 300Vrms

* *Multiply by the number of sections used for ballast line input.*

Examples—

For a reading of 100W at 50Hz, one ballast line input being used, PF = 0.97, the accuracy specification is—

(0.2% x 100W) + 0.02W = 0.22W

For a reading of 100W at 50Hz, one ballast line input being used, PF = 0.6, the accuracy specification is—

(0.275% x 100W / 0.6) + 0.02W = 0.478W

POWER FACTOR

	PF > 0.95	0.8 < PF < 0.95	PF < 0.8
50Hz	0.0006	0.0009	0.0014
60Hz	0.0007	0.001	0.0016
400Hz	0.004	0.006	0.01

Ballast Output Measurement Accuracy

All specifications are typical above 1MHz

Options HID or F limit specifications to a maximum frequency of 100KHz.

Tube Voltage

RMS MEASUREMENTS

(0.1% + 0.005% per KHz) reading + 0.1V* + 0.001V per KHz

Add 2% reading for voltages > 400Vrms (not option M)

* Change to 0.2V for option HID, 0.15V for option M

Example—

For a reading of 100V at 50KHz, the accuracy specification is—

(0.1% + 0.005% x 50KHz) x 100V + 0.1V + 0.001V x 50KHz = 0.5V

HARMONIC MEASUREMENTS

Harmonics: 10 (limited by 450KHz max. frequency)

Accuracy: RMS measurement accuracy + 0.5% reading x harmonic

PEAK MEASUREMENTS

RMS measurement accuracy + 1V*

Add 10V above 500Vpk (not option M)

* Change to 2V for option HID, 1.5V for option M

CREST FACTOR MEASUREMENTS

0.01 + (1* / Vrms)

Add 0.02 above 500Vpk (not option M)

* Change to 2 for option HID, 1.5 for option M

Example—

For a Tube Voltage of 100Vrms, the accuracy specification is—

```
0.01 + (1 / 100) = 0.02
```

Filament Voltage

This is not available in options QS or HID.

RMS MEASUREMENTS

(0.1% + 0.005% per KHz) reading + 0.02V + 0.0002V per KHz

Example—

For a reading of 3V at 50KHz, the accuracy specification is—

```
(0.1% + 0.005% x 50KHz) x 3V + 0.02V + 0.0002V x 50KHz = 0.0315V
```

Tube and Filament Current

RMS MEASUREMENTS

(0.15% + 0.005% per KHz) reading + 0.5mA*

Add (0.5mA* / PF) per 100V across tube per 100KHz, if PF < 0.85

* Change to 1mA for option HID or HC, 2mA for options HID and HC.

Examples—

For a reading of 300mA at 50KHz, tube voltage = 100Vrms, PF = 0.95, the accuracy specification is—

```
(0.15% + 0.005% x 50KHz) x 300mA + 0.5mA = 1.25mA
```

For a reading of 300mA at 250KHz, tube voltage = 100Vrms, PF = 0.95, the accuracy specification is—

```
(0.15% + 0.005% x 250KHz) x 300mA + 0.5mA = 4.7mA
```

For a reading of 300mA at 250KHz, tube voltage = 100Vrms, PF = 0.8, the accuracy specification is as above—

```
 + (0.5mA / 0.8) x (100V/100V) x (250KHz/100KHz) =7.2625mA
```

HARMONIC MEASUREMENTS

Harmonics: 10 (limited by 450KHz max. frequency)

Accuracy: RMS measurement accuracy + 0.5% reading x harmonic

PEAK MEASUREMENTS

RMS measurement accuracy + 5mA*

* Change to 10mA for option HID or HC, 20mA for options HID and HC.

Crest Factor Measurements

0.01 + (0.005* / Arms)

* Change to 0.01 for option HID or HC, 0.02 for options HID and HC.

Example—

At a current reading of 300mA, the accuracy specification is—

0.01 + (0.005 / 0.3A) = 0.027

Total, Tube and Filament Power

Below 20KHz:	0.15% + 0.05% / PF
20KHz- 500KHz:	(0.005% + 0.003% / PF) per KHz
500KHz- 2MHz:	(0.0075% + 0.005% / PF) per KHz
	Add 0.05W* + (0.002W* per KHz) for total tube power Add 0.0075W* + (0.00025W* per KHz) for filament power Add 2% reading for voltages > 400Vrms (not option M)

* Multiply by 2 if option HID or HC, multiply by 4 if both option HID and HC. Multiply by 1.5 if option M.

Examples—

For a reading of 40W at 30KHz, Load PF = 0.96, the accuracy specification is—

[(0.005% + 0.003% / 0.96) x 30KHz x 40W) + 0.05W + (0.002W x 30KHz)] = 0.2075W

For a reading of 40W at 250KHz, Load PF = 0.96, the accuracy specification is—

[(0.005% + 0.003% / 0.96) x 250KHz x 40W) + 0.05W + (0.002W x 250KHz)] = 1.3625W

For a reading of 40W at 250KHz, Load PF = 0.8, the accuracy specification is—

[(0.005% + 0.003% / 0.8) x 250KHz x 40W) + 0.05W + (0.002W x 250KHz)] = 1.425W

Frequency

Min. Input:	15V*
Accuracy:	5KHz – 2MHz : 0.01% + 0.01KHz 20Hz – 2KHz : 0.01% + 0.1Hz

* Change to 30V for option HID, 20V for option M.